GEOLOGY, GEOCHEMISTRY AND MINERAL POTENTIAL OF INTRUSIVE ROCKS IN THE EASTERN CENTRAL MINERAL BELT OF LABRADOR: REGIONAL GEOCHEMICAL DATA AND PRELIMINARY INTERPRETATION.

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EXPLANATORY NOTE

This open file report was prepared in early 1988 as an interim presentation of results from the Central Mineral Belt Granitoid Project. As of release (early 1989) preparation of a final project report which will supersede this account is underway.

The main purposes of this open file are to (a) release numerical data (b) release maps showing geochemical variation in intrusive rocks and (c) present descriptions of units. No attempt has been made to synthesize or interpret petrological or geochemical data. Unit descriptions, correlations and groupings may be subject to revision as new data is accumulated or existing data reexamined during final report preparation. Geochemical data itself may be changed with the incorporation of repeated analyses for Zr, as the analytical method used initially has now been shown to be an underestimate. No sample location maps are included in this report, but UTM coordinates are provided for all samples. The 1:250,000 summary geological map is intended to accompany geochemical variation maps at the same scale, and is not intended to replace published 1:100,000 and 1:50,000 scale geological maps of areas covered by this release, which remain the primary reference material for bedrock geology, and from which this map is partly compiled.

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SUMMARY

This report presents preliminary results from a large scale mapping and lithogeochemical sampling program aimed at assessing the mineral potential of voluminous intrusive rocks in the eastern central mineral belt of Labrador. Data is presented in raw numerical format, as summary tables showing univariate statistics for individual units, and as a series of 1:250,000 proportional symbol maps showing spatial geochemical variation. A 1:250,000 geological map of the area, incorporating results of this project and previous mapping, is released in preliminary form.

Intrusive rocks within the area can be divided into 4 broad assemblages on the basis of lithology, deformational state and unit geometry. A group of granitoids showing penetrative NE to N trending foliations were affected by deformation in the Makkovikian Orogeny, and are termed the Makkovikian batholith; U-Pb age data suggest that they are older than 1800 Ma, and may include rocks as old as 1950-1900 Ma. Post-tectonic, largely undeformed intrusive rocks include both post-Makkovikian intrusions of ca. 1800 Ma age, and also younger "Trans-Labradorian" intrusions of ca. 1650 Ma age . Previous interpretations of post-tectonic intrusions as a single coherent suite of ca. 1650 Ma age ("Trans-Labrador Batholith") appear to be overly simplistic. The two generations of post-tectonic intrusions cannot be separated easily by field characteristics, and they are thus grouped purely on lithology and unit geometry. Post-tectonic intrusions are divided into nafic and intermediate rocks, ranging in composition from olivine-gabbro to syenite, and two suites of granitoids termed "regional units" and "smaller plutons". It appears that all of these groups include intrusions of both 1800 Ma and 1650 Ma age. Regional units form extensive homogeneous plutons occupying structural blocks inferred to represent intermediate levels of the granitoid terrane, whereas smaller plutons form small discordant bodies within blocks thought to represent high crustal

levels. Major and trace element geochemical patterns suggest that the latter group has a more restricted compositional range and a more fractionated character relative to the regional units. A number of the smaller plutons host or are associated with Mo-Cu, U, Pb-Zn and F mineralization. Geochemical patterns (in particular trace elements) that they can be divided into three suites with contrasting affinities, discriminated mostly by variations in the levels of F, HFS elements and REE.

Assessment of spatial geochemical variation throughout the area, coupled with summary statistics for individual units, suggest that a number of intrusions meet criteria established for definition of possible specialized granitoid suites. These include a number of the smaller granitoid plutons, including units not at present known to be associated with or host mineralization, and also syenitic to granitic rocks that probably represent a residuum from one of the mafic to intermediate plutons. Most of these areas of potential are in the north of the study area, within crustal blocks that preserve large amounts of country rock lithologies, and which probably represent apical portion(s) of the batholith(s). Spatial geochemical variation suggests that there is a general northward increase in incompatible elements and chemical parameters indicative of igneous fractionation. All of these areas merit attention, but the greatest potential for mineralization appears to be in those units that preserve original contacts with their host rocks, and in which contactward geochemical zonation suggests mass transport or concentration of incompatible and ore elements towards the roof of the intrusion. The existence of such patterns can be demonstrated in at least one such intrusion. Two foliated granitoid units of pre- or syn-Makkovikian age may also have some potential. The results of follow-up sampling intended to assess geochemical variation within units will be discussed in a forthcoming report.

TABLE OF CONTENTS

1. INTRODUCTION 1

2. GEOLOGY 5

2.1 REGIONAL GEOLOGICAL FRAMEWORK 5
2.2 GENERAL GEOLOGY OF THE STUDY AREA 6
2.3 BASEMENT ROCKS 6
2.4 SUPRACRUSTAL ROCKS 6
2.5 FOLIATED INTRUSIVE ROCKS 6
2.6 POST-TECTONIC INTRUSIVE ROCKS 6
2.6.1 Mafic to intermediate rocks 6
2.6.2 Regional granitoid units 6
2.6.3 Small Granitoid plutons 6
2.6.4 Unfoliated pegmatite 6
2.7 MINERALIZATION 6

3. GEOCHEMISTRY 62

3.1 INTRODUCTION 62
3.2 GENERAL GEOCHEMICAL PATTERNS 62
3.3 REGIONAL SPATIAL GEOCHEMICAL VARIATION 70
3.3.1 Major element variation patterns 70
3.3.2 Normative parameters 74
3.3.3 Trace element variation patterns 74
Incompatible trace elements 76
Compatible trace elements 77
Other trace elements 83
Trace element ratios 86

4. SUMMARY and DISCUSSION 90

REFERENCES 97

APPENDICES: Table 4 -- Univariate Summary Statistics for Units
Table 5 -- Average compositions of specialized suites
Table 6 -- Regional geochemical data listing
Table 7 -- Follow-up geochemical data listing
Table 8 -- Assorted geochemical data listing

ENCLOSURES: Geological map and legend (Scale 1:250,000)
Geochemical Variation Maps (Scale 1:250,000)

1. INTRODUCTION

The Central Mineral Belt of Labrador (Greene, 1978) is the principal area of exploration in Labrador for commodities other than iron ore. It has been the focus of several studies by the Department of Mines and Energy, notably those of Gower et al.,(1982) and Ryan (1995). The principal targets during over three decades of sporadic mineral exploration in the belt have been the Lower-Middle Proterozoic supracrustal sequences of the Aillik Group, Moran Lake Group, Bruce River Group and Seal Lake Group. Far less attention has been paid to the (predominantly granitoid) intrusive rocks that are present throughout the belt, and their role in the genesis of mineralization in the supracrustal rocks has not been assessed. This open file report is intended to address this gap and assesses the mineral potential of these rocks with reference to a large geochemical database assembled during 1985 and 1986. The project is of regional extent, and this report forms only one aspect of a co-ordinated investigation of the belt. Work over the same period of time by D.Wilton and co-workers (Wilton et al.,1986,1987) has emphasized more detailed studies of known mineralization, and has added considerably to the usefulness of the data.

Aims and Objectives of The Project

The main objectives of this project are to characterize and assess the mineral potential of intrusive rocks associated with known mineralization in the eastern CMB and, via a lithogeochemical exploration program, define areas of similar intrusive rocks elsewhere in the belt. A secondary objective is to refine geological map coverage in areas underlain by intrusive rocks, and to evaluate the role of middle Proterozoic magmatism in the evolution of both the CMB and central Labrador in general. A 1:250,000 compilation map of the eastern CMB is released in preliminary form with this report; revised versions of 1:100,000 map sheets for the area will form part of a final project report.

Location, Access and Topography

The location of the area covered in this project is shown in figure 1. The area is topographically varied; in the east and north it consists of a rugged and mountainous terrain incised by several deep fiords (e.g. Hebbeville Bay) and protected by numerous offshore islands. In contrast, the southern and western parts of the area consist of a heavily glaciated, variably wooded, boulder-strewn, flat-lying plateau where the best exposures are found on hilltops or in rivers, and geologists are the only individuals foolish enough to attempt overland travel during the summer.

The communities of Hebbeville and Postville in the north of the area are the only logistical bases available for field work; both are served by the Marine Atlantic coastal boat service from June to November, and (weather permitting) by scheduled (semi-) flights operated by Labrador Airways. The project was operated mostly from Hebbeville, and also from a BRINEX LTD field camp at Melody Lake, some 30 km south-west of Postville.

The coastline provides access to much of the northern and eastern parts of the area, but realistic access to the hinterland is possible only by air. Most of the geochemical sampling and geologic mapping during this project was carried out with extensive helicopter support.

Previous Work - General Information

Thorough and detailed descriptions of previous work and mineral exploration throughout the area are given by Gower (1981), Gower et al.(1982) and Ryan (1985) and only a brief review is presented here.

The earliest work consisted largely of descriptions of coastal outcrops (Leiber,1860; Packard,1891; Daly,1902) , with some later mapping along the coast by officers of the Newfoundland Geological Survey and Geological Survey of Canada (Kranck,1939;1953; Christie et al.,1953; Douglas,1953) . 1:250,000 geological mapping was completed by the Geological Survey of Canada (Stevenson,1970; Taylor,1975).

In 1970 prospectors and discoverers near Hanover, leading eventually to a 30-year period of mining and lesser base metal exploration by British Newfoundland Exploration Company Ltd (BRINEX) and several junior mining companies. Most of the exploration and research work done 1950 to 1970 was related to the search for economic mineralization in sulphide-bearing supracrustal sequences. However, several more general studies were carried out for university theses, including regional geological and structural work by Clark (1970,1973) and Marten (1977) in the Hanover and Holyrood Bay areas, and petrochemical studies of sulphide bearing volcanic rocks of the Bobbie Group by White (1970) and Dyson (1980).

The Mineral Development Division started work in the area in 1970 and completed regional 1:100,000 mapping in 1980 (Bailey,1970; Bailey et al.,1970; Dyson and Kerrio,1970; Sidorsky,1980; Green,1980). Compilation and synthesis of this information was presented by Green et al.(1980) for the eastern half and by Bailey (1978) and Dyson (1980) for the west. Attention during these mapping programs was directed mainly towards supracrustal sequences and associated mineralization, but the great importance of post-tectonic granitoid rocks was recognized, as was their polyphase and compositionally variable nature. The geology of many inland areas underlain by granitoid rocks remained very poorly known.

Previous Work Under This Project

Re-examination and sampling of a number of showings in the eastern part of the CMB during 1984 (Wardle, 1984; Wardle and Wilton, 1984) kindled fresh interest in both the gold potential of the area and the possible importance of post-tectonic granitoids as hosts or progenitors to mineralization. The current project commenced with geochemical sampling and mapping in 1985, which led to revision of existing unit designations and definition of new regional granitoid units (Kerr, 1986). Analysis of geochemical data from this phase of the project led to the identification and delineation of several areas of granitoids considered to show some of

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from hornblende- peridotite to alkali-feldspar granite. In previous reports (Kerr,1986,1987), most of these post-tectonic intrusions were grouped with the Trans-Labrador Batholith, in accordance with available K-Ar and Rb-Sr geochronology suggesting ages of ca. 1650 Ma. New U-Pb geochronological data (Krogh, unpub. data) suggests that this may be an oversimplification; there are certainly some ca. 1800 Ma granitoids within this group that are post-orogenic with respect to the Makkovikian Orogeny. As of writing, the relative importance of ca.1800 Ma and ca. 1650 Ma intrusions is not at all clear, as there appear to be no reliable field criteria for their distinction.

In this report, a broad three-fold division is employed which partially reflects compositional groupings, but is also based on characteristics thought to reflect different levels of exposure. Post-tectonic intrusions are divided into a mafic to intermediate assemblage, consisting of gabbro to syenite intrusions, and two assemblages of siliceous granitoid rocks termed "regional units" and "smaller plutons". The latter occur mostly in the northern part of the area, where they form discrete bodies enclosed by Aillik Group country rocks; they are thought to represent relatively high crustal levels compared to regional units. All three groups probably include intrusions of both ca.1800 Ma and ca.1650 Ma age; their relative extent will hopefully be revealed by further U-Pb geochronology (currently in progress).

5. Post- 1650 Ma intrusive rocks of mafic composition (Michael Gabbro suite). These consist of sills and dykes of olivine gabbro and gabbronorite which were emplaced ca.1450 Ma, and intrude all of the above packages. They occur mostly in the south of the area, and are variably affected by Grenville deformation and metamorphism. Spectacular corona structures around igneous olivines are developed in response to metamorphism, and these dykes provide valuable indicators of the severity of Grenville events in any one area.

Overview of Structural Patterns

The structural geology of the eastern CMB is discussed in detail by Gower et al.(1982), Ryan (1985), and in thesis studies by Clark (1973,1979) and Marten (1977). The study area is dominated by two major structural features. The older of these is a NNE-trending strongly deformed fold/thrust belt along Kaipokok Bay, whose trend is also shared generally by penetrative fabrics in Makkovikian granitoids. This is the "Makkovik trend" of Ermanovics et al. (1982), and represents structures developed during the Makkovikian orogeny. Major faults associated with this trend include slide and thrust zones along Kaipokok Bay, and possibly also the Ranger Bight Slide of Clark (1973,1979), which has a similar orientation. The second dominant trend is of broadly E-W orientation, and is probably related to the Grenvillian Orogeny at ca. 1000 Ma, although it is possible that some structures associated with this trend may originally have developed during the Labradorian orogeny. It is manifested by E-W penetrative fabrics and gneissosity in granitoids in the south of the area, and more obviously by a number of major E-W trending faults that divide the area into a number of major blocks. The most prominent is the Benedict fault system, which is taken to be the location of the Grenville Front Zone (Gower et al.,1980; Gower and Ryan,1986). This is a south-dipping zone of intense deformation and mylonitization up to 1 km in width, to the south of which all rocks are strongly deformed and/or gneissic. It is probably a high-angle reverse fault or possibly a thrust fault (Gower,1981). Subsiduary fault systems to the north of the Benedict Fault system include the Adlavik Brook Fault system (Gower et al.,1982), which also appears to juxtapose radically different levels of the crust, and has a recognisable transcurrent component of ca. 20-30 km. North of this zone, post-tectonic intrusive rocks are generally undeformed, and contacts with their country rocks are well-preserved; most of the smaller granitoid plutons lie in this area. The area between these two fault systems shows a heterogeneous development of strongly foliated and

cataclastic zones with trends that generally parallel those of the major faults. This area is dominated by "regional" granitoid units, and contains less country rock material.

The NE to NNE "Makkovik trend" and the E to ENE "Grenville trend" are distinct in the east and north of the area, but their discrimination becomes more difficult in the west. There is a regional flexure in the trend of the Grenville front zone in this direction, and both trends converge into a general NE direction. The strongly foliated to gneissic granitoids south of the Benedict Fault system are of uncertain affinity; they could be equivalent to either the Makkovikian or Trans-Labrador Batholith, or both.

Definition and Description of Units

The following sections provide descriptions of the field and petrographic characteristics of major intrusive units defined by previous geological mapping (Gower,1981; Gower et al.,1982; Ryan,1985) and by mapping and geochemical sampling carried out under this project. Unit Numbers refer to map units on the included 1:250,000 Scale map, and also to the field "UNIT" in the analytical listings of Appendix 1. Note that the gaps in the numbering system employed for geologic units are planned; room has been left for definition of additional units without disrupting the coding system employed in computer files. Recent U-Pb zircon dates (discussed above) neccessitate some revision of groupings previously suggested (Kerr, 1986,1987). The order of description and numbering system employed thus do not reflect relative ages except in the most general sense; where available, geochronological data is summarized for each unit.

2.3 BASEMENT ROCKS

Unit 1 : Archean Quartzofeldspathic Gneisses and Presumed Equivalents.

Archean basement rocks were not a specific target of this study, but were examined briefly in a number of locations.

Archean basement is present in a number of inliers within the strongly deformed belt of Aillik Group rocks along the south side of Kaipokok Bay, where it is described by Marten (1977) and Gower et al.(1982) as layered granodioritic gneiss containing amphibolite pods and layers, and also including nebulitic granitoid rocks of probable anatectic origin. An inlier of probable Archean basement near Walker Lake (Ryan,1985) is described in similar terms.

The Cape Harrison Metamorphic Suite (Gower,1981), well exposed in the extreme east of the area, has been grouped with Archean gneisses for the purposes of this report. It consists of layered to massive gneisses ranging from monzodiorite to granodiorite composition, but locally includes fairly massive, foliated granitoid rocks (Gower,1981). Structural trends within the CHMS are dominantly N to NNE trending, resembling the "Makkovik Trend" noted above. The absolute age of the CHMS is unknown, but it contrasts strongly with granitoid rocks exposed nearby, and is clearly intruded by post-tectonic granites. Field relations, however, do not rule out a lower Proterozoic age for parts of the CHMS, and the N to NNE structural trends suggest that it was affected by the Makkovikian Orogeny.

2.4 SUPRACRUSTAL ROCKS (Aillik Group)

Unit 2 : Lower Aillik Group.

The Lower Aillik Group was not examined in detail during this study. Detailed descriptions of this important supracrustal sequence and its numerous significant uranium deposits are provided by Bailey (1979), White and Martin (1980), Evans (1980), Gower et al.,(1982) and Ryan (1985). The following description is taken from these sources.

Within the study area, rocks of the lower Aillik Group are confined to the fold belt along Kaipokok Bay, where they consist of a lower strongly deformed amphibolite unit, which is overlain by graphitic and sulphide-bearing pelitic metasediments, in turn overlain by a thick sequence of metabasalts and intercalated metasediments. Metasediments in the upper part of the sequence are largely of tuffaceous aspect, but include some chemical sediments such as silicate-oxide iron formation.The contact between the basal amphibolite and underlying Archean gneisses is a zone of ultradeformation interpreted as a thrust. Similar thrusts (see above) are also present at higher structural levels within the Lower Aillik sequence, and may have been an important structural control for U mineralization.

Unit 3: The Upper Aillik Group

The Upper Aillik Group forms the most extensive supracrustal package in the study area, and is the dominant country rock lithology to the intrusive rocks described below. It is described in detail by Bailey (1979), White and Martin (1980), Evans (1980) and Gower et al.,(1982), and has been examined during this project in a number of areas, mostly adjacent to the outer contacts of granitoid plutons. Quartz- and quartz-feldspar porphyries which form part of the Upper Aillik Group were also sampled as part of the geochemical program. Gower et al.,(1982) defined seven principal units within the Upper Aillik Group; for the purposes of this report, the group is subdivided into a clastic sedimentary and volcanosedimentary component (Unit 3.1), a dominantly felsic volcanic and volcaniclastic component (Unit 3.2), and a group of subvolcanic intrusive rocks (Unit 3.3).

Unit 3.1 includes arkoses, banded tuffs, laminated sandstones and siltstones, conglomerates, breccias and minor mafic volcanic and tuffaceous lithologies, none of which have been examined or sampled under this project. Unit 3.2 is the dominant lithology of the Upper Aillik Group and includes crystal and crystal-lithic tuffs, massive rhyolites, minor bedded tuffaceous rocks of subaqeous origin, tuffaceous sandstones. Unit

3.3 includes massive quartz and quartz-feldspar porphyries.
In most areas, felsic volcanic rocks of the upper Aillik Group have sufferred extensive recrystallization during greenschist to lower amphibolite facies metamorphism, and primary volcanic textures are generally not present. The effects of regional metamorphism are compounded by further recrystallization around larger granitoid plutons as a result of contact metamorphism.

The most common lithology within Unit 3.2 encountered during this project is a fine to very fine-grained, pink to grey or buff, variably banded metavolcanic rock showing a saccharoidal texture and a blotchy appearance resulting from pervasive recrystallization. Volcanic textures are only rarely preserved, and in many cases it is impossible to differentiate between massive rhyolite and crystal tuff. Larger grains of quartz, K-feldspar and plagioclase are present in many examples, and may represent either phenocrysts or broken crystals. The banding may represent a deformed flow-banding, but in many cases relict fragmental textures are present, suggesting that it may locally result from deformation of lithic tuffs or agglomerates. Lithic fragments, in many cases recognisable only as blotches or diffuse ellipsoids, are present locally in most of the Upper Aillik Group volcanic rocks examined during this project and, unless they represent xenoliths entrained in rhyolitic flows, would suggest a volcaniclastic origin for much of this material, perhaps as airfall or ash-flow tuffs. The few areas where Upper Aillik group volcanic rocks preserve original volcanic textures, e.g. at Ranger Bight in Makkovik Bay, and at Michelin Ridge, also consist dominantly of volcaniclastic material, with subordinate rhyolite flows.

In thin section, pervasive recrystallization has obliterated virtually all original textures, leaving a groundmass of very fine grained quartz and feldspar, containing a few broken crystals or phenocrysts preserved as coarser aggregates. The most common "phenocryst" phases are K-feldspar and plagioclase; quartz is less abundant. The mafic mineral assemblage in most samples has been degraded to aggregates of iron oxide,

sphene, chlorite and epidote, usually in elongate clusters aligned with the foliation in the rocks. Amphibole (actinolite, more rarely hornblende) and pyroxene are present locally. Blue amphibole of sodic composition, associated with accessory fluorite, is a distinctive component in some areas, particularily adjacent to some small granitoid plutons in the north of the area. It is uncertain whether this is a primary or metasomatic feature.

Unit 3.3 consists of several areas of feldspar- and quartz-feldspar porphyry. The most prominent of these is at White Bear Mountain, which consists of a highly distinctive purple or grey porphyry with large (up to 2 cm) feldspar phenocrysts and smaller rounded (resorbed ?) quartz eyes. Similar, but less spectacular varieties are present near Round Pond (MacDougall, in prep.) and south of Cape Strawberry, and also on offshore Islands. Extremely fresh and massive quartz-feldspar porphyry, along with well preserved rhyolite and agglomerate, are present in a belt of volcanic rocks south-east of Stag Bay. Although this area is included with the Aillik group in this report, lack of deformation suggests that it may represent a younger volcanic sequence, perhaps equivalent to the TLB. A body of feldspar porphyry delineated by Gower et al.,(1982) south of Monkey Hill could not be located; this area is underlain by medium to coarse grained foliated granitoid rocks assigned to the Makkovikian Batholith.

Relationships between subvolcanic intrusive rocks and the dominantly subaerial rocks of Unit 3.2 were not examined in this study. Previous workers, notably Bailey (1981), observed possible zonation in the White Bear Mountain porphyry and also suggested that subvolcanic intrusive rocks passed gradationally into felsic volcanic rocks in several areas.

2.5 FOLIATED INTRUSIVE ROCKS

Foliated granitoid rocks intrude both the Archean basement rocks and supracrustal rocks of the Aillik Group. They are mostly characterized by N

to NE trending foliations similar in orientation to structural trends within the Aillik Group, and are thus inferred to have undergone at least the later deformational events that affected the supracrustal package. Marten (1977, summarized by Gower et al.,1982) has documented cross-cutting relationships in the Kaipokok Bay area suggesting that their emplacement post-dated the formation of the major D_2 tectonic slides within and beneath the Lower Aillik Group, but predated or accompanied subsequent upright D_3 deformation. The term "Makkovikian Batholith" was proposed by Kerr (1986) for these rocks; this is retained in this report, but may also be applicable to some post-tectonic intrusions previously grouped with the Trans-Labrador Batholith.

Foliated granitoid rocks are concentrated mostly in the north-west of the study area, where they form a belt of discrete plutons spatially associated with the zone of intense folding and deformation along Kaipokok Bay. They are also present in the extreme east of the area, on the peninsula north of Jeanette Bay, and as part of an inlier in the Manak Island area. A total of eight units are defined within this group. These include all of the "synkinematic" granites described by Gower et al.(1982), and some of the rocks which they included as "remobilized Archean gneisses", notably the Brumwater granite of Marten (1977). The strongly migmatitic and agmatitic remobilized gneisses around Kaipokok Bay are here included with the Archean (Unit 1).

Unit 10; Long Island quartz monzonite

This unit is principally exposed in an elongate body extending from Long Island to the Kitts Pond area, and also forms two narrow belts southeast of Post Hill. Gandhi et al.(1969) termed the unit "Long Island gneiss", but, as it is only locally gneissic, subsequent workers have preferred the term "Long Island quartz monzonite" (Gower et al.,1982).

The unit is dominated by grey-weathering, fine to medium grained, foliated, melanocratic, hornblende-biotite granitoids showing a characteristic plagioclase-porphyritic texture. Field observations suggest

that the most common rock types are quartz monzonite, granodiorite and (more rarely) monzogranite. Deformed inclusions of more mafic (typically dioritic) composition are common, and are most evident in marginal portions of the body. In local zones of very strong deformation inclusion-rich variants grade into banded or schlieric rocks; these are the only components that can truly be described as gneissic. The unit as a whole is homogeneous in composition.

A penetrative fabric is present almost everywhere within the unit, and is defined by alignment of biotite and hornblende aggregates and by flattening of plagioclase phenocrysts and mafic inclusions. The fabric is most strongly developed in marginal areas; central parts of the body are weakly foliated to locally massive. Marten (1977) considered this to be a D_3 fabric, and documented intrusive relationships between the quartz monzonite and surrounding Archean and Aillik Group lithologies. In the Duck Island area, the Long Island Quartz monzonite is disrupted and net-veined by fine-grained granites of the Duck Island Stock, grouped with the Monkey Hill granite (Unit 42). The Long Island Quartz Monzonite has been dated at 1832 +/- 58 Ma by K-Ar methods (Gandhi et al.,1969) and at 1802 + 13/-7 Ma by U-Pb methods using zircons (Scharer et al.,1988).

In thin section, typical examples consist dominantly of quartz (10-20%), microcline (30-40%), plagioclase (An_{30}; 30-40%), blue-green hornblende and biotite (10-25% combined). Groundmass quartz and feldspar is extensively recrystallized to polygonal aggregates; Plagioclase phenocrysts are poorly twinning, locally zoned, and variably recrystallized and saussuritized. Sphene is the most prominent accessory component, and is intergrown with iron oxides, hornblende and biotite. Hornblende and biotite occur in subequal quantities as recrystallized aggregates, and show no evidence of a replacement relationship, except in strongly deformed areas where aggregates of fine grained biotite, associated with chlorite and epidote, are the dominant mafic component. Apatite and zircon are also present as accessory phases.

Unit 11: Kennedy Mountain Granite and Related Rocks

This is a new unit which incorporates units 17a and 17c of Gower et al.(1982), and also new areas of foliated granitoid recognized during this study. It includes five geographically discrete bodies which show very similar characteristics. The type locality forms a prominent mountain opposite Makkovik Harbour; this unit was originally termed the Kennedy's Cove gneiss by Clark (1973), but, as in the case of the Long Island body, the rocks are rarely gneissic, and they are not actually exposed on the shore. The best outcrops are on the hilltops, and the name has been changed accordingly.

The Kennedy Mountain granite is dominated by pink to white or buff, medium to coarse grained, variably K-feldspar porphyritic, foliated hornblende-biotite monzogranite, granite and (more rarely), alkali feldspar granite. In the Makkovik Bay area, the unit intrudes supracrustal lithologies of Unit 3, but is itself intruded by the post-tectonic Monkey Hill granite (Unit 42).

The more melanocratic variants of Unit 11 contain up to 15 percent combined mafic phases, but most examples contain 5 percent or less. Some areas, in particular the large area southeast of Monkey Hill, include highly leucocratic rocks which are locally alaskitic. K-feldpsar phenocrysts (in variable states of deformation) are a common feature; plagioclase phenocrysts are more rarely present. Within each of the bodies, rocks lacking K-feldspar almost completely occur locally; these are also quartz-rich and mafic-poor and are dominated by albite-oligoclase feldspar. These may be original compositional variants, or perhaps originally potassic rocks which have been altered (albitized?) by hydrothermal fluids. The rocks are completely recrystallized and it is therefore difficult to discern any textural evidence of alteration.

Minor fluorite (locally up to 1 percent) is a common feature of many granites within this unit. It occurs as small grains intergrown with mafic mineral aggregates, and also in coarser patches along foliation planes. Sphene is also very prominent in many samples.

Unit 11 is variably foliated in outcrop and hand specimen; the general trend of penetrative fabrics is NNE to NE, but is locally variable. The most obviously foliated rocks are invariably those which are most melanocratic, where biotite-hornblende-sphene aggregates define anastomosing fabrics around augened K-feldspar phenocrysts. In equigranular and leucocratic variants, the fabric is more difficult to discern as there is very little anisotropy to define it, and some granites are macroscopically massive. Most, however, are pervasively recrystallized and display shape fabrics in thin section. Coarse pegmatite veins and sheets are widespread locally contain fluorite and pyrite, and are gossaned in some areas.

In thin section, typical examples consist mostly of quartz (15-35%), microcline (25-60%), plagioclase (An_{20-30}; 10-50%), hornblende and biotite (2-15% combined, subequal amounts). Quartz is variably recrystallized, but locally retains vestiges of an interstitial habit. Microcline phenocrysts are coarse patch perthites, locally with rims of sodic plagioclase. Biotite, hornblende and sphene are the dominant mafic phases, and form coarse recrystallized aggregates, intergrown with abundant octagonal opaque grains and locally abundant zircon, apatite and allanite. The more leucocratic and quartz-rich variants with up to 1% fluorite commonly lack hornblende. Chlorite and/or epidote are locally important as alteration products of hornblende and biotite. Euhedral to aggregate sphene, zircon, allanite and apatite are very obvious and abundant accessories in most samples.

Unit 12: Melody Granite and Related Rocks

The term Melody granite is proposed for an elongate unit of potassic granitoid which extends from the Melody Lake area to the western boundary of the study area, and probably continues into the area mapped by Ryan (1985). It includes Unit 14 of Bailey (1979), and parts of units 23 and 24 of Ryan (1985). These rocks are strongly deformed and recrystallized in most areas and display N to NNE trending penetrative fabrics; the unit is

therefore grouped with foliated granitoids south in this report. The contact relations of this unit are uncertain; most of its boundaries correspond with inferred fault zones.

The Melody granite is dominated by pink to brick-red, coarse-grained, variably K-feldspar porphyritic, strongly deformed, leucocratic granite (s.s) and alkali-feldspar granite. Texturally, it consists largely of augen granitoids with strongly cataclastic or protomylonitic fabrics. There are essentially two textural variants, defined mostly by variation in total mafic content, but similar in most other respects. More melanocratic variants retain more obvious porphyritic textures, as the mafic aggregates help to define augen; however, leucocratic variants are also strongly K-feldspar porphyritic in most areas. The distribution of these two variants in map sheet west of Melody Lake corresponds generally to the pattern of units 23 and 24 of Ryan (1985), compiled from earlier work by BRINCO Ltd.

In Thin section, typical examples consist mostly of quartz (15-40%), hematized microcline (30-65%), plagioclase (An20-30; 20-40%), biotite, chlorite, epidote and sphene (2-7% combined). Quartz and feldspars are strongly recrystallized, often ribbon-like in geometry, and cut by microcrystalline mylonitic zones. Microcline augen or phenocrysts are slightly perthitic, but commonly contain inclusions of plagioclase. Plagioclase augen or phenocrysts, where present, are strongly saussuritized. The mafic mineral assemblage depends on the degree of deformation and metamorphism; the best-preserved samples contain aggregates of fine-grained green-brown biotite, locally with relict hornblende, whereas strongly deformed variants contain only sphene - chlorite - epidote aggregates along foliation planes. Accessory allanite is common in most samples; zircon, fluorite and apatite have also been observed.

Unit 13: Foliated Granitoids of The Anna Lake Area

This unit is present in a small area south of Anna Lake and includes units 10 and 11 of Bailey (1979), and unit 19 of Ryan (1985). This is a

composite unit and locally includes more than one intrusive phase. It is dominated by strongly foliated and locally layered rocks ranging in composition from quartz diorite to granite (s.s.) and displaying a NW to NNW trending foliation which is discordant to the dominantly NNE trend typical of other foliated granitoid units. It includes two separate units of amphibolite, which share this trend, and also numerous thin amphibolite layers and pods. A few layers of possible metasedimentary origin were also observed. Granitoid rocks within unit 13 are highly variable in texture and composition, and visible outcrop-scale compositional layering suggests that the area may have suffered extensive transposition. This unit may represent an element of Archean basement and granitoids produced by remobilization during the Paleoproterozoic Orogeny. It is certainly not a homogeneous pluton in the sense of the other Paleoproterozoic granites described above. A U-Pb zircon date of 1985 +/- 15 Ma was obtained from this unit by Brooks (1983). This used 3 of 5 zircon fractions; if all data is used, the age is a less precise 1928 +- 120 /-65 Ma.

Unit 14: Brumwater granite

The Brumwater granite is a small, tabular body that is contained within the Archean inlier southwest of Kitts Pond. It was defined initially by Marten (1977), and was grouped with "remobilized Archean rocks" by Gower et al.(1982: Unit 13). Marten (1977) describes a gradational relationship between this unit and migmatized Archean gneisses at Unlucky Head, supporting interpretation as an anatectic derivative of the basement rocks. Enclaves of gneissic material are locally present, and a "ghost layering" imparts a nebulitic appearance to many outcrops. Scharer et al (1988) obtained a U-Pb monazite age of 1796 +/- 2 Ma from a biotite leucogranite which cuts migmatites correlated with the Brumwater granite.

Unit 14 consists mostly of grey to pale pink, foliated to lineated equigranular leucocratic biotite granite, showing a foliation defined by

[illegible]

Unit 22: Rice Lake granite

The Rice Lake granite, defined and named by Barlow (1977), is a pink, tabular body that is confined to and includes the eastern semicircumferential unit of the Lower Felsic Group in the Rice Lake area.

It is dominated by white to pale pink or buff, medium grained, equigranular, foliated to lineated muscovite-biotite granite, locally containing porphyritic and/or quartzose patches. It truncates the foliation in the host semicircumferential rocks, but displays a concordant attitude with respect to regional compositional layering in the Lower Felsic Group. Xenoliths of semicircumferential material closely similar to the country rocks are common throughout, and sporadic amphibolite xenoliths also occur. A "ghost layering" is evident in places, and both layering and internal fabrics are locally complexly folded on an outcrop scale.

In this section, typical examples consist mostly of quartz (25-31%), microcline (30-40%), plagioclase (An$_{20-25}$; 20-30%), muscovite and biotite (5-11% combined, muscovite dominant).

Unit 23: Parent Island granodiorite

This unit is geographically distinct from all of the units described above, and is located near Adlard Bay. It is grouped with the Batholithic Batholith on the basis of a moderate N trending foliation, which contrasts strongly with the undeformed intrusive rocks which surround it. It forms an inlier associated with semicircumferential rocks of the Upper Felsic Group, which is sandwiched between the gabbro-diorite of the Adlard Intrusive suite (Units 20,21) and adjacent monzonite and quartz monzonite (Unit 23). This inlier probably represents a screen between younger intrusions.

Unit 16 is dominated by homogeneous, white to pale grey, medium to coarse grained, foliated, equigranular to locally porphyritic, leucocratic biotite - granodiorite, showing a weak to moderate foliation defined by biotite aggregates. A small sliver of the unit on the mainland is intruded by gabbro and diorite of the Adlavik Intrusive Suite. It was previously grouped with the Cape Strawberry granite (Unit 43, see below) by Gower et al.,(1982) , based on previous mapping by BRINCO and Clark (1973), but has little in common with this unit.

In thin section, Unit 16 consists mostly of quartz (15-20%), microcline (20-40%), plagioclase (An_{25-35}; 40-60%) and green-brown biotite (5%). All components form recrystallized to polygonal or lepidoblastic aggregates, with the exception of scattered microcline phenocrysts, which retain subhedral shapes. Plagioclase grains are slightly saussuritized and zoned where recrystallization is slight. Apatite and sphene are present as accessory phases, and chlorite and epidote are associated with biotite, probably as alteration products.

Unit 17; Deus Cape granodiorite

This unit is present in the extreme east of the study area, where it lies between post-tectonic granitoids and the Cape Harrison Metamorphic complex. It has been visited only in one locality during this project, where it was sampled for U-Pb geochronology. The age indicated is 1837 +6 /-4 Ma, suggesting that it should be grouped with the Makkovikian Batholith. It is described in detail by Gower (1981), who describes it as a coarse grained, pink to grey, K-feldspar megacrystic to seriate granodiorite, with biotite and relict blue-green hornblende as mafic phases.

2.6. POST-TECTONIC INTRUSIVE ROCKS

Post tectonic intrusive rocks form the most extensive and compositionally variable lithologic group within the area. They can be divided into 21 units, grouped broadly into three major divisions, namely mafic to intermediate rocks, regional granitoid units and smaller granitoid plutons. Previous reports (Gower et al.,1982; Kerr, 1986,1987) have considered all post-tectonic intrusions to be part of the Trans-Labrador batholith; this must now be revised in view of the recognition of undeformed granitoids of ca.1800 Ma age amongst all three groupings.

2.6.1 Mafic To Intermediate Plutonic Rocks (Units 20 to 26)

This grouping includes the Adlavik Intrusive Suite (Gower et al.,1982), and other quartz-poor rocks ranging in composition from gabbro to syenite and quartz syenite. The latter include monzonite, quartz momzonite and syenite that were grouped with the Adlavik Intrusive Suite by Kerr (1986,1987). Regional mapping and sampling during this project has shown that a similar package of rock types is present in an large inland area between White Bear Mountain and Big River, which are also spatially associated with gabbro-diorite of the Adlavik Suite. The close association and compositional similarity suggested that these rock types should all be grouped together. However, recent U-Pb age determinations from the quartz monzonite and syenite of the Adlavik Islands suggests that these units may be of ca.1800 Ma age, in contrast to the ca.1650 Ma age obtained from monzonite of the Adlavik Suite at Adlavik Bay. An extensive unit of diorite, monzonite, syenite and minor granite exposed in the Benedict Mountains is also included within the mafic to intermediate group. At the present time, the term Adlavik Intrusive Suite refers to the gabbro and diorite of Units 20 and 21.

Unit 20: Gabbro, Gabbronorite and Leucogabbro

This is superbly exposed around Adlavik Bay, and also in a number of other coastal locations between Big River and Tukialik Bay. The displaced southern component of this unit is poorly exposed in the valley of Big River and on isolated hilltops which protrude through valley alluvium. A small area also occurs in the west of the study area, south of East Micmac Lake. The gabbro intrudes the Upper Aillik Group near Adlavik Bay, but is itself cut by fine-grained granitoids grouped with the Monkey Hill granite (Unit 42).

Kerr (1987b), following on earlier work by Clark (1979) divided the gabbro into four subunits, which are (1) marginal gabbro and diabase, (2) mafic cumulates, (3) massive melanocratic gabbro and (4) plagioclase cumulates. These subunits also represent the inferred stratigraphic sequence within the intrusion. The first three subunits are of restricted extent and are exposed mostly around the margins of the body; the dominant rock type elsewhere is plagioclase cumulate. Rhythmic layering, graded bedding, scour structures and cross-bedding are developed most spectacularily in the mafic cumulate subunit, but are present on a local scale throughout all units, and in the diorite of Unit 21.

Mafic cumulates appear to form irregular "cyclic" units. These include coarse grained ultramafic rocks at the base, consisting primarily of amphibole and biotite, but with a variably preserved primary pyroxenite mineralogy, interlayered with and overlain by gabbros containing cumulus mafic phases (originally clinopyroxene, transformed to hornblende) and (locally) cumulus apatite. Euhedral hornblende crystals with typical pyroxene habit and cores of augite define rhythmic layering and graded bedding within these rocks. The mafic cumulates are associated with very coarse grained amphibole-plagioclase-K feldspar "pegmatites" with minor sulphide, which characteristically disrupt and overly cumulate gabbro, and underly the ultramafic base of the overlying cyclic unit.

The mafic cumulates are overlain by massive, grey to black, coarse grained, melanocratic gabbro, which in turn grades upward into the

dominant plagioclase-cumulate leucogabbro. Despite the dark weathering colour, the massive gabbro is also a plagioclase cumulate, although its plagioclase content is typically less than 50 percent (An_{40-70}). In thin section, the freshest rocks also contain pale green augitic clinopyroxene (20-50%), and red-brown biotite (5-15%). Green or green-brown hornblende is almost always present, but in highly variable amounts. In fresh, augite-bearing variants it is present as a mantle on pyroxene crystals, suggesting that it is either a late primary phase or a deuteric alteration product of the clinopyroxene. In other areas, clinopyroxene is totally absent, or present only as relict cores within hornblende.

The dominant plagioclase cumulate is a grey to white or purple-brown, coarse to very coarse grained leucogabbro or leucogabbronorite showing interstitial oikocrystic mafic phases and a magmatic foliation defined by alignment of plagioclase laths. Diffuse mafic crystal accumulations provide evidence of cumulate processes, and locally define trough-bedded structures, or thin zones of rhythmic layering similar to those seen within the mafic cumulates lower in the intrusion. The orientation of layering within the cumulates can vary widely within a single outcrop. In thin section, the plagioclase cumulate displays a varied mafic mineral assemblage, showing a contrast between fresh rocks containing pyroxene and biotite, and more altered variants where amphibole is dominant. Most examples consist of plagioclase (An_{40-80}; 30-75%), augitic clinopyroxene (10-50%), green or brownish hornblende (5-50%) and red-brown biotite (5-20%). Microcline and quartz (0-7%) are present as minor interstitial components, and an interstitial "granophyre" is locally present. They range from fresh rocks with only minor hornblende as a mantle on augite crystals to more altered lithologies consisting of saussuritized plagioclase, hornblende and fibrous actinolite. As in the case of the melagabbro, it appears that hornblende is a late-magmatic or deuteric phase; most of these rocks were probably originally pyroxene-bearing. Leucogabbronorite is subordinate to leucogabbro, and appears to be restricted mostly to the western portion of the main body. In addition to

5-20% pleochroic hypersthene, the gabbronorite variants contain 5-20% olivine, commonly mantled by orthopyroxene aggregates. The most abundant minor phases are apatite (in some cumulates, there may be up to 2 or 3 percent), sphene (generally in the hydrated amphibole-bearing rocks), and abundant iron oxide, probably mostly magnetite. Minor pyrite and/or chalcopyrite is locally present.

In addition to the four mappable subunits described above, two other rock types occur throughout the intrusion. Coarse grained to very coarse grained dioritic "pegmatites" are common, and presumably represent a late stage volatile-rich phase. They are most common in the mafic cumulate rocks, where they form volatile-rich "tops" on cyclic units. They consist of plagioclase (50-70%), acicular to prismatic hornblende (20-60%), interstitial microcline (0-15%), quartz (0-5%) and minor sulphide, chiefly pyrite.

Fine to medium grained diabase is also a widespread component. This material forms numerous dykes and diffuse zones which almost invariably display a chaotic internal structure where diabase has been net-veined and disrupted by granitic (s.l) material or by rock types that appear to be hybrids between the diabase and the leucogabbro wall rocks. In many cases chilled margins can be recognized on individual diabase pillows, but these are cut by hybrid rock types which appear to originate in the wall rocks. Preferred orientation of diabase lozenges in such zones suggests that these were zones of flow, and it is likely that they represent feeders to overlying parts of the intrusion. They were probably emplaced into hot, recently solidified cumulates which still contained residual liquid that could mix and interact with the diabase.

Unit 21: Diorite and Monzodiorite

This unit appears to be gradational with unit 20 and is more homogeneous in appearance. It does not necessarily form the uppermost layer of the gabbro-diorite sequence; Unit 21 locally dips to the northwest beneath leucogabbro, and it may represent a discontinous layer in the middle of the sequence.

The dominant rock type is a pale brown to pink or yellow, coarse grained, equigranular to plagioclase porphyritic, hornblende-pyroxene or two pyroxene diorite, quartz diorite or monzodiorite. K-feldspar and quartz display well-developed interstitial habits. It contains inclusions of massive leucogabbro, layered cumulates and a distinctive K-feldspar porphyritic monzonite that also occurs as dykes which intrude the underlying leucogabbro. There is, however, no clear contact between the leucogabbro and the Unit 21; this appears to be a gradational transition.

Cumulate textures are locally developed throughout the unit as wispy mafic layers, primary foliations defined by plagioclase alignment and, in one area, by a thin (10m) zone of mafic and ultramafic cumulates. Patches of coarse amphibole-feldspar pegmatite are present locally.

In thin section typical examples consist mostly of plagioclase (An_{40-50}; 40-65%), quartz (0-5%), microcline (5-25%) ,clinopyroxene, hornblende and biotite (10-20% combined). There is a gradation from virtually anhydrous rocks where hornblende forms a thin mantle on clinopyroxene to variants which lack pyroxene and contain euhedral, probably primary amphibole. Red-brown biotite is present in most examples, and also appears to be a primary phase. A few diorites, usually the more plagioclase-rich variants, contain pleochroic hypersthene and green augite in subequal amounts. On a local scale, Unit 21 is quite potassic, and a few samples could be described as monzonite. These contain accessory zircon in addition to the normal sphene and apatite, and one such sample has yielded a U-Pb zircon age of 1649 +/- 1 Ma (Scharer, unpub.data). This is presumed to also indicate the age of the gabbro of Unit 20.

Unit 22; Plagioclase-Porphyritic Monzonite

Unit 22 occurs on a mappable scale only to the south of the Adlavik Brook Fault zone, where it is sandwiched between units 23 and 24, although contact relations with these units are unknown. Rocks which resemble it are also present locally within Unit 21. It consists of grey to dark brown, coarse to very coarse grained, monzodiorite containing large,

euhedral to subrounded plagioclase phenocrysts. Mafic silicates, quartz and K-feldspar display an interstitial habit.

In thin section typical examples consist mainly of quartz (0-10%), plagioclase (An_{35-50}; 30-70%), microcline (15-40%), clinopyroxene, hornblende and biotite (10-25% combined). Clinopyroxene and red-brown biotite are the dominant mafic phases in fresh examples, and hornblende forms a mantle on pyroxene grains. At the other extreme, some altered variants consist largely of saussuritized plagioclase and hornblende, with minor relict clinopyroxene. Orthopyroxene is rare, but occurs in minor amounts (5%) at one locality; apatite, sphene and iron oxide are the most abundant minor components. The age of this unit is unknown; it could be related to the gabbro and diorite of Units 20 and 21, or to the monzonite and syenite of Units 23 and 24. It is in physical contact with the latter.

Unit 23; Monzonite and Quartz Monzonite

Unit 23 underlies almost all of the Adlavik Islands in the northern zone, and a poorly exposed area south of the Adlavik Brook fault zone, in the valley of Big River.

Unit 23 is dominated by homogeneous pink, grey or white, coarse grained, variably porphyritic pyroxene - hornblende - biotite monzonite, quartz monzonite and syenite containing distinctive euhedral crystals of hornblende and biotite up to 5mm in size. The most common phenocryst phase is K-feldspar, but many examples also contain plagioclase phenocrysts. Most of the body is inclusion-poor, containing a few blocks of leucogabbro or diorite. It is cut by feldspar and quartz-feldspar porphyry dykes assigned to the nearby Dog Island granite (see below).

The western boundary of the unit, where it abuts against Units 20 and 21, includes a complex agmatite zone up to 1 km in width. The best leucogabbro that resemble Units 20 and 21. A flow fabric is visible around the larger inclusions. On the southern shore of Adlavik Bay, a compositionally similar agmatite zone, containing the same assemblage of

paleosome and neosome, exhibits a moderate to strong N trending foliation, which is also shared by mineral fabrics in included gabbro blocks, which are transformed to amphibolites. These relationships were previously taken to indicate emplacement of Unit 23 into units 21 and 22 (Gower et al.,1982; Kerr,1986). Recent U-Pb ages from the agmatite leucosome at Adlavik Bay suggest crystallization at ca.1801 Ma (Krogh, unpub.data), implying that these rocks predate the gabbro-diorite of the Adlavik Bay area, and that the inclusions therefore represent an earlier cycle of mafic plutonism of pre-1800 Ma age.

In thin section, typical examples consist mainly of quartz (5-20%), microcline (30-50%), plagioclase (An_{30-40}; 30-50%), hornblende and biotite (5-25% combined). Microcline occurs as variably perthitic phenocrysts up to 2 cm in diameter, commonly accompanied by plagioclase phenocrysts, locally with K-feldspar rims. Quartz shows an interstitial habit. Hornblende and biotite are both euhedral to subhedral, and present in roughly subequal amounts. Clinopyroxene is present in a number of samples, where it is a relict phase preserved in the cores of hornblende crystals. Hornblende is in places poikilitic, with numerous small inclusions of quartz. Sphene, iron oxide and zircon are present as prominent accessory phases; allanite and fluorite are less common.

Unit 24; Syenite and Quartz Syenite

Unit 24 occurs on the outer Adlavik islands, and also forms an extensive inland area north of White Bear Mountain. In the former area, it corresponds in a general sense with Unit 31 of Gower et al.,(1982), and in the latter location, corresponds partly with the Tarun Syenite of Gandhi et al.,(1969) and Gower et al.,(1982; Unit 26c). Field relations with Unit 23 are not clear; the two rock types are locally very similar and their contact may be gradational. Syenite from Kikkertavak Island has given a U-Pb zircon age of 1801 Ma (Krogh, unpub.data) suggesting a close relationship to unit 23.

Unit 24 is dominated by pink, chocolate brown or grey-green, coarse grained, K-feldspar porphyritic syenite and quartz syenite containing

interstitial quartz and mafic phases. Very deep weathering is characteristic of many parts of the unit. In thin section, typical examples consist mostly of quartz (0-15%), microcline (40-80%), plagioclase (15-30%), clinopyroxene, hornblende and biotite (5-20% combined). Microcline occurs as large (up to 4 cm diameter) phenocrysts displaying coarse string perthite textures; plagioclase is generally confined to the groundmass. The dominant mafic phases are green, locally pleochroic clinopyroxene (possibly aegirine-augite or an iron-rich variety) altered to hornblende, but some samples contain only hornblende and red-brown biotite. A few variants also contain variably retrograde fayalitic olivine, altered to iron oxide aggregates. The olivine is probably responsible for the deep weathering exhibited by some parts of the unit. Euhedral zircon crystals up to 2 mm in length are present in some samples, and apatite is also locally important. Sphene is associated with iron oxide aggregates.

Unit 25 : Mount Benedict Monzonite-Syenite

Unit 25 underlies most of the Benedict Mountains area between the projected traces of the Adlavik Brook Fault zone and the Benedict Fault zone. It corresponds with Units 21 and 22 of Gower (1981). Unit 25 is divided into 4 subunits, ranging in composition from olivine-bearing gabbronorite to alkali-feldspar syenite. The contact relations of Unit 25 are not known with certainty; it is suspected that both northern and southern margins correspond with major fault zones, but the relationships with the volcanic rocks east of Stag Bay are unknown.

Unit 25.1 is the most distinctive variant of the unit, and is restricted to its southwestern edge. It is dominated by grey to black and white plagioclase-phyric gabbroic to dioritic rocks with textures suggesting a cumulate origin. Large, subhedral plagioclase crystals range up to 5 cm in size, and vary in shape from euhedral to rounded, suggesting resorption by the magma. K-feldspar, mafic silicates and (minor) quartz show interstitial to oikocrystic habits.

In thin section, the freshest examples consist of quartz (0-2% at most), microcline (5-15%), plagioclase (up to An_{60}, 50-80%), ortho- and/or clinopyroxene (5-20% combined), hornblende (0-10%), and biotite (0-5%). Many examples contain equant serpentine-iron oxide clots that are probably relict olivine, as they show distinctive fracture patterns outlined by opaue iron oxides. Fresh samples contain both faintly pleochroic hypersthene and a purplish titanaugite with exsolution lamellae suggesting that it is an exsolved pigeonite; the two pyroxenes are present in roughly subequal amounts. Clinopyroxene displays more extensive alteration to hornblende. Apatite is a prominent interstitial minor mineral. Most samples display variable amounts of (deuteric?) alteration, and plagioclase laths are locally intensely saussuritized. In the more altered variants, pyroxene grains are extensively altered to both hornblende and fibrous actinolite, and it is difficult to establish the presence of orthopyroxene.

Unit 25.1 resembles leucogabbro and leucogabbronorite of the Adlavik Intrusive Suite (see above).

Unit 25.2 is the dominant lithology throughout the Benedict Mountains. It is quite variable in field appearance, and ranges in colour from grey to pink or buff, and in grain size from medium to coarse. The most typical examples are grey or buff, seriate to porphyritic monzonite, quartz monzonite and syenomonzonite displaying a plagioclase porphyritic texture. This texture is variably visible in hand specimen, but becomes very obvious in stained slabs. The groundmass consists of a medium grained aggregate of quartz, K-feldspar and mafic silicates. Plagioclase phenocrysts commonly show a rounded and embayed shape suggesting that they have been resorbed by the magma or replaced by K-feldspar. This texture, termed "speckled eggshell" by Gower (1981), is present throughout Unit 25.2, although the proportion of plagioclase phenocrysts is highly variable.

In thin section, typical examples consist mostly of quartz (0-10%), microcline (20-60%), plagioclase (30-60%), clinopyroxene (0-5%), hornblende and biotite (5-15% combined). Quartz and microcline show well developed interstitial habit, and are locally intergrown as fine-grained granophyre. There are two generations of plagioclase; phenocrysts are zoned and saussuritized, whereas groundmass plagioclase (An_{25-30}) forms euhedral laths intergrown with quartz. In some examples plagioclase phenocrysts are mantled by fresh plagioclase resembling the groundmass variety, but in other cases the phenocrysts appear to be mantled or replaced by microcline. Pyroxene is a relict phase, and is commonly preserved only in the cores of hornblende crystals in relatively mafic variants. Both hornblende (olive green to blue-green) and biotite occur as euhedral to subhedral crystals and aggregates, commonly intergrown with sphene and iron oxide. Some distinctive variants contain hornblende crystals with sphene cores. Allanite, apatite, fluorite (especially in syenitic variants) and zircon are all present as prominent accessory phases.

Unit 25.3 is a fine to medium grained, generally equigranular syenitic to granitic lithology that occurs mostly on the higher peaks of the Benedict Mountains, in particular around Mount Benedict. It is dominated by pink to buff, medium-grained, locally porphyritic syenite, quartz syenite and granite (s.s). K-feldspar is the most common phenocryst phase, but some samples contain rounded plagioclase phenocrysts and display the "speckled - eggshell" texture typical of Unit 25.2. The unit is locally a feldspar or quartz-feldspar porphyry of subvolcanic aspect. No intrusive contacts with units 25.1 or 25.2 have been observed; the common textural features of all three suggest a gradational relationship.

In thin section, typical examples consist of quartz (5-15%, locally up to 30%), microcline (50-80%), plagioclase (10-35%), biotite and amphibole (5-8% combined). Quartz and microcline typically form graphic groundmass intergrowths; microcline may also form well-twinned subhedral phenocrysts with relict simple twinning. Plagioclase phenocrysts are absent or vestigial only. Biotite is the dominant mafic phase, forming

subhedral single crystals or aggregates with associated (usually relict) hornblende. Hornblende also forms pokilitic crystals in some samples. Accessory phases are very prominent, and include sphene, zircon and widespread fluorite.

Unit 25.4 is a pink to grey, coarse grained quartz syenite present south of Jeanette Bay. It corresponds with Unit 22 of Gower (1981), which he considered to be closely related to the rocks described above. It contains phenocrysts of both microcline and plagioclase, and locally shows mantled textures of "pseudorapakivi" type, which may be a variant of the "speckled-eggshell" texture typical of Units 25.2 and 25.3. True rapakivi textures are present locally. The groundmass is, however, richer in plagioclase than otherwise similar syenomonzonites of Unit 25.2. The plagioclase cores to K-feldspar phenocrysts are commonly zoned and saussuritized, and the mafic mineral assemblage has been extensively retrograded to chlorite - epidote - sphene aggregates. In fresh examples, the unit contains subequal amounts of biotite and hornblende (5-15% combined), and local relict clinopyroxene.

2.6.2 REGIONAL GRANITOID UNITS

Regional granitoid units form large, texturally homogeneous bodies from 100 to 500 km^2 in areal extent. These units mostly underly regions of the study area where Aillik Group country rocks are of limited extent, and their contacts with these rocks, where mapped, are normally defined by faults. Most of these areas occur south of the Adlavik Brook fault zone and are considered to represent deeper crustal levels than the north of the area,where the smaller plutons occur. Five regional units are recognized within the study area.

Unit 30; Freshsteak granodiorite

The Freshsteak granodiorite occurs in two discrete bodies that are separated and offset by the Adlavik Brook fault zone; these are interpreted to be displaced portions of an originally continous pluton. The northern area is a subdivision of Unit 27 of Gower et al.(1982) and the southern area is broadly equivalent to Unit 13 of Bailey (1979). The contacts between Unit 30 and surrounding rocks are poorly exposed and have not been observed. Contacts with Units 11 and 12 are probably intrusive, since both of these units are widely foliated. The relationship between Unit 30 and Unit 33 (Bayhead granite) is unknown. A preliminary (4 points only) Rb-Sr isochron from the Freshsteak Lake area (Kerr, unpub.data) suggests an age of 1898 +/- 100 Ma. Although imprecise, this appears to suggest that this unit is not a ca.1650 Ma intrusion, despite its generally unfoliated appearance.

Unit 30 is dominated in both areas of exposure by grey to grey-brown or grey-green, fine to medium (locally coarse-) grained, variably plagioclase porphyritic, quartz monzonite, granodiorite and monzogranite. In most areas it is a massive rock with a slightly recrystallized appearance in hand specimen, but locally displays a foliation defined by alignment of mafic silicates. This foliation is most pronounced in areas closest to the inferred position of the Adlavik Brook fault zone. Small

plagioclase phenocrysts (up to 1 cm in size) are a characteristic feature, and are locally associated with K-feldspar phenocrysts of a similar size range.

In thin section, typical examples consist mostly of quartz (10-30%), microcline (30-50%), plagioclase (An25-40; 30-50%), hornblende and biotite (5-20% combined). Where K-feldspar phenocrysts occur, they are typically coarse flame or string perthite. Plagioclase phenocrysts are commonly zoned, containing saussuritized cores. Groundmass quartz and feldspar grains commonly display some evidence of recrystallization; however, graphic interstitial quartz - K-feldspar intergrowths are preserved locally. Hornblende and biotite are present in subequal quantities, and are commonly intergrown with iron oxide and sphene; hornblende may be locally poikilitic. Pale green clinopyroxene is present locally as a relict phase, mantled by hornblende and/or biotite. The most prominent minor phases are sphene and apatite; zircon and allanite are less common.

Unit 31: Big River granite

Unit 31 underlies at least 400 km^2 in the southeast of the study area, and may also be represented in a deformed condition by some of the granitoid gneisses included in Unit 50. It is one of the most distinctive units within the area, characterized by mantled plagioclase phenocrysts with K-feldspar rims for which the term "pseudorapakivi texture" is used in this report. It is divided into two textural variants; Unit 31.1 is the dominant megacrystic granitoid, and Unit 31.2 is a subordinate equigranular phase.

The western boundary of Unit 31 coincides with a very prominent linear escarpment along the southern side of Big River valley. This is inferred to represent the trace of a major fault that links the Benedict and Adlavik Brook fault zones. To the west of this fault zone, mafic to intermediate rocks of units 20 to 24 are massive and almost completely undeformed, whereas the Big River granite, although dominantly massive, is

locally foliated and cataclastic in appearance. A preliminary (5 point) Rb-Sr isochron from this unit (Kerr, unpub.data) suggests an age of 1836 +/- 40 Ma. This suggests that Unit 31 may form part of a post-Makkovikian granitoid suite, rather than being a Trans-Labrador granite. It is, however, very similar lithologically to many megacrystic granites assigned to the TLB elsewhere.

Unit 31.1 is dominated by pink to red or white, coarse grained, K-feldspar porphyritic, leucocratic, hornblende-biotite granite and alkali-feldspar granite, locally ranging in composition to quartz monzonite and quartz syenite. K-feldspar phenocrysts range up to 3 cm in size, and range from euhedral to ovoidal in shape. They typically consist of a white or grey plagiclase core, enclosed by a white or pink-red K-feldspar mantle of variable width. This pseudorapakivi texture is variably developed, but is present in at least vestigial form in almost all samples of the unit. Rocks in which phenocrysts consist entirely of K-feldspar are interpreted to be the end result of the mantling process. Mafic enclaves, of both gabbroic and amphibolitic aspect, are present on an outcrop scale.

Massive variants of this granite are dominant in the northern part of Unit 31, but variably foliated and/or cataclastic rocks characterize the southern portion of the unit, and become more common close to the Benedict fault zone. Foliations are defined both by K-feldspar augen, locally with vestigial pseudorapakivi texture, and by alignment of mafic silicates. The transition between foliated and massive granite appears to be gradational. Gower et al.(1982) included some rocks south of the Benedict fault zone as gneissic variants of this unit; these are grouped with Unit 50 in this report.

In thin section, typical examples of Unit 31.1 consist of quartz (20-35%), microcline (40-70%), plagioclase (An_{20-35}; 10-40%), hornblende and biotite (2-10% combined). Quartz has a variably preserved interstitial habit, and displays limited recrystallization and polygonization in the north. Microcline is typically medium to coarse string perthite, with

inclusions of plagioclase. Where forming mantles in composite phenocrysts, it consists of a coarse mosaic of grains around a saussuritized, commonly zoned plagioclase core. Both plagioclase and microcline are present also as groundmass phases; microcline is also present locally as subhedral optically continous phenocrysts that lack plagioclase cores. Hornblende and biotite occur in roughly subequal amounts; hornblende is a deep green or blue-green variety of possibly sodic composition. Greenish, locally faintly pleochroic clinopyroxene (possibly aegirine-augite) is present rarely as a relict phase, altered to amphibole and/or biotite. Sphene is a very prominent minor phase (up to 1%), and occurs as euhedral to subhedral crystals intergrown with hornblende, biotite and iron oxides. Allanite, apatite and zircon are all prominent as accessory phases, and two samples contain up to 1-2% disseminated pyrite.

Foliated and/or cataclastic variants of Unit 31.1 display a similar felsic mineral assemblage, but show much more intense recrystallization and locally display very fine grained mylonitic zones parallel to the foliation. The mafic mineralogy in these rocks is dominated by chlorite, epidote and sphene; igneous hornblende and biotite are variably preserved.

Unit 31.2 occurs mostly in the southeast of the unit, and was formerly designated as a separate unit by Kerr (1986) who grouped it with the smaller plutons. It is dominated by pink to buff, medium to coarse grained, generally equigranular, leucocratic granite and alkali feldspar granite. Although texturally distinct from Unit 31.1, it is similar to it in thin section, and is here interpreted as a variant of it. Similar lithologies occur as isolated samples throughout the area shown as Unit 31.1.

Unit 32: Otter Lake - Walker Lake granite

Unit 32 underlies at least 350 km^2 in the southeast corner of the study area. It corresponds broadly to unit 32 of Ryan (1985), which was grouped with spatially associated muscovite-biotite granites to form the Nipishish Lake Intrusive Suite. Rocks of similar kindred are recognisable

for over 50 km along strike to the southwest of the study area, and display moderate to strong Grenvillian deformation. Ryan (1985) considered all of these to represent a single body of batholithic dimensions; the following description applies only to the less deformed rocks within the study area.

Contacts between Unit 32 and other map units have not been examined in this study, but Ryan (1985) describes an intrusive contact between granodiorite and metasedimentary rocks of the Upper Aillik group from the Walker Lake area. Similar intrusive relationships with the younger supracrustal sequence of the Bruce River Group are reported from Del Rizzo Lake, southwest of the study area. The Bruce River Group, previously dated by Rb-Sr methods at ca. 1520 Ma (Kontak, in Ryan,1985), has now been dated at 1649 +/- 1 Ma using the U-Pb method on zircon (Scharer et al.,1988). Assuming that the granites are equivalent, this places an upper limit on the age of the Otter Lake - Walker Lake granite. The contact between Unit 32 and the Melody granite (Unit 12) is placed farther north than the contact between equivalent units shown by Ryan (1985). This position corresponds with a major fault zone whose trend parallels that of the Benedict fault zone. Fault-bounded blocks of Melody granite and Archean gneisses are also present within fault systems that transect Unit 32 (Ryan, 1985).

The Otter Lake - Walker Lake granite is dominated by grey to pink or green-white, medium to coarse grained, porphyritic to seriate quartz monzonite, granodiorite and monzogranite. Melanocratic dioritic variants occur locally. Most examples show well-preserved porphyritic textures and a seriate to equigranular groundmass with interstitial, commonly blue-grey quartz grains. Both K-feldspar and plagioclase phenocrysts are present; in most examples the former are much larger, ranging up to 3-5 cm in size. Plagioclase shows a distinctive greenish colour in some samples due to epidote and saussurite alteration. The mafic silicates form "clots" in some relatively melanocratic variants, but in most cases they are dispersed evenly through the rock.

In thin section, typical examples consist mostly of quartz (15-30%), microcline (30-50%), plagioclase (An_{25-40}; 25-50%), hornblende and biotite (3-8%). Quartz forms optically continous interstitial crystals, locally slightly strained. Microcline phenocrysts are finely perthitic and locally have rims of sodic plagioclase. Plagioclase phenocrysts display normal zonation, and contain saussuritized centers. Both feldspars are also present in a seriate to equigranular groundmass. Green or green-brown biotite is the dominant mafic silicate, associated commonly with lesser amounts of green hornblende. Relict clinopyroxene, altered to hornblende, is present only rarely. Sphene is abundant in most samples, and locally occurs in amounts comparable to hornblende or biotite. It forms euhedral or subhedral crystals up to 3 mm in size, and in places displays a clear interstitial habit, suggesting that it was a late-crystallizing phase. In some granites it is intergrown with amphibole and biotite. Epidote and/or chlorite are important as alteration products of plagioclase, and also become the dominant mafic silicates in the more strongly deformed examples. Allanite, apatite and zircon are present, but are not as prominent as in other post-tectonic granitoid rocks.

Unit 33: Bayhead granite

Unit 33 is a new unit representing a subdivision of Unit 27 of Gower et al.(1982). It is best exposed in the hills around the head of Kaipokok Bay, and is thus assigned the informal name Bayhead granite. It forms a body of approximately 30 x 7 km stretching from Freshsteak Lake to East MicMac Lake. The southern boundary of the unit is formed by the Adlavik Brook fault zone, and the northern boundary is formed by an inferred east-trending fault zone that also truncates Archean rocks and Makkovikian granitoids of the Kaipokok Bay fold-thrust belt. The contact relations of the Bayhead granite are thus unknown, although it is presumed to intrude the foliated Melody granite (Unit 12) at its western extremity. To date, no displaced equivalent of the Bayhead granite has been recognized south of the Adlavik Brook fault zone. This suggests that the granite was either

geographically restricted to the north side of the fault or that the upthrown block to the south of the fault represents a level of the crust below the emplacement level of the granite. The age of the unit is unknown; the similarity with the Cape Strawberry granite (see below) suggests that it may be of similar age, possibly as old as 1800 Ma.

The Bayhead granite is dominated by massive, pink, white or red, coarse to very coarse grained, variably K-feldspar porphyritic, leucocratic biotite granite (s.s), commonly containing minor fluorite. The unit is extremely homogeneous and bears a strong resemblance to some of the smaller, specialized, granitoid plutons exposed in the north of the area, in particular the Cape Strawberry (Unit 43) and Dog Island (Unit 44) granites. K-feldspar is the most common phenocryst phase; plagioclase locally also forms phenocrysts, and large anhedral patches of grey quartz may be vestiges of a quartz-porphyritic texture. Faint layering, defined by accumulations of mafic silicates, is developed on an outcrop scale and may represent some type of cumulate process. The unit contains gabbroic enclaves, and, one one hilltop, is cut by flat-lying felsite sills that may have been feeders to associated volcanic rocks.

In thin section, typical examples consist mostly of quartz (20-45%), microcline (30-65%), plagioclase (An_{15-25}; 10-40%) and biotite (1-5%). Quartz forms anhedral masses, locally interstitial to K-feldspar, and displaying variable amounts of strain and recrystallization. Microcline is usually a coarse string or flame perthite and, where present as phenocrysts, shows both simple and polysynthetic twinning. It is variably hematized. Plagioclase is usually restricted to the groundmass. Biotite is the dominant mafic phase, and consists of large euhedral to subhedral crystals or aggregates of green-brown hue, showing variable alteration to chlorite along cleavage traces, and almost completely replaced in hematized variants. Blue-green amphibole is present locally as a relict phase. Sphene, fluorite, allanite and zircon are all present as prominent minor phases, generally associated with biotite crystals and aggregates.

Unit 34: Stag Bay granite

Unit 34 is exposed over an area of approximately 100 km^2 immediately south of Stag Bay, at the western end of the Benedict Mountains. It corresponds to Unit 19 of Gower (1981), and to a portion of Unit 26 of Gower et al.(1982). Gower (1981) grouped the Stag Bay unit with the megacrystic granodiorite exposed near Deus Cape, and with similar granitoids in the Byron Bay area. The Stag Bay unit is also similar in appearance to parts of the Otter Lake - Walker Lake granite. The relationships between Unit 19 and surrounding units are unknown. At Stag Bay it is cut by a feldspar-porphyry dyke which may be related to the nearby Dog Island granite, or to nearby subvolcanic porphyries in the Benedict Mountains.

Unit 34 is dominated by a compositionally and texturally variable assemblage of grey to pink or buff, medium to coarse grained, porphyritic and/or seriate-textured granodiorite, monzogranite, granite (s.s) and (locally) alkali-feldspar granite. Both K-feldspar and plagioclase are present as phenocryst phases; the former are generally larger, ranging up to 5 cm in size. In the north the unit is massive, but the southern part is locally foliated and/or cataclastic. This area is cut by several faults associated with the Adlavik Brook Fault zone, and foliation directions are highly variable.

In thin section, typical samples consist of quartz (15-35%), microcline (25-65%), plagioclase (15-50%), hornblende (0-5%) and biotite (5-10%). Quartz displays variable recrystallization and locally shows a relict interstitial habit. Microcline phenocrysts commonly display coarse patch perthite textures; smaller plagioclase phenocrysts are subrounded and zoned, containing strongly saussuritized cores. Green biotite is the dominant mafic phase, and occurs in aggregates, intergrown with sphene, epidote and variable amounts of chlorite in foliated variants. Sphene is very prominent, forming euhedral to subhedral crystals. Apatite, zircon and allanite are the most common accessory phases.

2.6.3 SMALL GRANITOID PLUTONS

In addition to the regional granitoid rocks described in the preceding section, post-tectonic intrusive rocks also include a number of smaller, more localized plutons, most of which are located in the north of the area as discrete bodies separated from one another by Aillik Group country rocks. A total of seven units are recognized within this lithologic group. Kerr (1988) defined three suites amongst these rocks, termed the Monkey Hill, Strawberry and Lanceground Intrusive Suites.

Unit 40: Witchdoctor Granite

The Witchdoctor granite underlies a poorly exposed zone in the south of the study area, between Walker Lake and the east end of Witchdoctor Lake. It corresponds to Unit 26e of Gower et al.(1982). It was assigned by Kerr(1988) to the Monkey Hill Intrusive suite, and is considered to be closely related to the adjacent Burnt Lake granite (see below). Contacts between the Witchdoctor granite and surrounding lithologies are not exposed. Brooks (1983) obtained a U-Pb zircon age of 1632 +/- 9 Ma from rocks assigned to this unit, suggesting that it is a Trans-Labrador granite.

The Witchdoctor granite is dominated by pink to white, medium to coarse grained, variably foliated, leucocratic biotite and biotite-muscovite granite to alkali-feldspar granite. Most examples are homogeneous, euigranular rocks. Foliations, where visible, are generally oriented E-W, and are therefore probably of Grenvillian age. The unit is mostly free of inclusions and xenoliths.

In thin section, typical examples consist mostly of quartz (25-40%), microcline (40-70%), plagioclase (An_{20}; 10-25%), biotite and muscovite (1-5% combined). Quartz is commonly exensively recrystallized, forming elongate ribbon-like aggregates, although locally a vestigial interstitial habit is present. Microcline is a coarse string perthite and, although most samples appear equigranular in the field, forms a few phenocrysts with both simple and polysynthetic twinning. Plagioclase is present in the groundmass only, and is variably recrystallized but generally fresh.

Most examples contain a green-brown biotite intergrown with lesser amounts of muscovite, forming aggregates that define the foliation. Hornblende is locally present as a relict phase in muscovite-poor variants, and chlorite occurs locally as an alteration product of biotite. Pale pink garnet is a minor constituent of several samples, and epidote is present in most cases, intergrown with biotite and muscovite. The most common accessories are sphene and allanite; zircon is less common and fluorite rare.

Unit #1 ; Burnt Lake Granite

The Burnt Lake Granite is an elongate body that lies between the Witchdoctor granite and Upper Aillik Group metavolcanic rocks of the Michelin Ridge - MacLean Lake block. It corresponds to Unit 24 of Gower et al.,(1982). It was assigned to the Monkey Hill Intrusive suite by Kerr (1988). Most of the body is poorly exposed. Bailey (1979) described the contact with the Aillik Group rocks as gradational; however, MacKenzie and Wilton (1986) describe sharp intrusive contacts at several localities. The unit is not reliably dated; A Rb-Sr isochron by MacKenzie and Wilton (1988) suggests 1548 +/- 90 Ma, but this is probably disturbed by hydrothermal effects or the Grenville orogeny. Correlation with the adjacent Witchdoctor granite suggests that it is a TLB granite.

The Burnt Lake granite is dominated by white to pale grey or pink, fine to medium grained, equigranular, leucocratic monzogranite, granite and (locally) alkali feldspar granite. Some varieties are extremely depleted in mafic silicates and can be described as alaskitic. The textures are commonly sugary, and local recrystallization causes some problems in separating it from similarily saccharoidal Aillik metavolcanics.

In thin section, typical examples consist mostly of quartz (25-40%), microcline (25-45%), plagioclase (20-50%), biotite and muscovite (0-5% combined). Most samples have suffered some recrystallization, and original igneous textures, except for relict microcline phenocrysts, are

not readily discerned. Muscovite occurs both as intergrowths with biotite flakes of a similar size range, and as fine-grained fibrous aggregates of secondary appearance. It is absent in the more melanocratic variants. Allanite and sphene are the most prominent accessories, and minor garnet is present locally. Fluorite is rare.

Unit 42; Monkey Hill Granite and Related Rocks

The Monkey Hill granite is a composite unit in the sense that it includes at least 8 discrete intrusions or stocks, all of which show strong similarities suggesting that they have a common origin. Most of the areas of Unit 28a and 28b delineated by Gower et al.(1982) correspond to this unit. Most are in the Makkovik Bay - Adlavik Bay area, and they collectively form the nucleus of the Monkey Hill Intrusive Suite, which also includes the aforementioned Witchdoctor and Burnt Lake granites.

The type locality for Unit 42 is at Monkey Hill itself, where a small (<50 km^2) pluton intrudes Aillik group metasedimentary and metavolcanic rocks. The northern margin of this pluton intrudes the foliated granitoid rocks of Unit 11 . Similar granites occur at Duck Island, where they intrude foliated quartz monzonite of Unit 10, at Round Pond, and near Big Bight, where the Little Monkey Hill granite is correlated with dykes which cut gabbro of the Adlavik Intrusive Suite (Unit 20). Other bodies of the Monkey Hill granite occur on the Aillik peninsula, and possibly on Kidlaluit Island. Contact relations described above suggest that the unit is a 1650 Ma granite, although it has not yet been dated with precision. A Rb-Sr isochron of ca. 1520 Ma (Wilton, unpub. data) is probably affected by hydrothermal disturbance.

Unit 42 is dominated by grey to buff or pink, fine to medium grained, faintly porphyritic, leucocratic monzogranite and granite (s.s), locally ranging to alkali-feldspar granite. Most examples are very homogeneous in texture and lack inclusions of any type except near contacts. The Duck Island and Round Pond intrusions, which are mineralized, are locally pegmatitic and/or miarolitic. The main body at Monkey Hill contains a few

darker-coloured (cognate) xenoliths, but is otherwise remarkably homogeneous over nearly 1 km of vertical relief.

The presence of miarolitic and pegmatitic textures, and the generally fine grained nature of the unit, suggest emplacement at relatively high levels in the crust. "Tuffisite" breccias consisting of granite clasts in a biotite-rich matrix are locally exposed around Makkovik Bay, and suggest violent exsolution of dissolved volatiles.

In thin section, typical examples from all of the above areas show closely similar characteristics. They consist mostly of quartz (20-35%), microcline (30-50%), plagioclase (An_{15-25}; 30-50%), biotite and chlorite (0-4% combined). Quartz is fresh and undeformed, and commonly shows an interstitial habit. Microcline is fresh, faintly perthitic and well twinned, and forms anhedral groundmass grains and, locally, graphic intergrowths with quartz. Plagioclase occurs as small (up to 5mm), euhedral to subhedral laths that appear to have crystallized early and, although similar in size to other phases, have the appearance of phenocrysts. They characteristically show saussuritized cores, and may be slightly zoned. Green or green-brown biotite occurs as small dispersed crystals or aggregates displaying variable alteration to chlorite along cleavage traces. Many samples lack biotite completely, and contain only chlorite aggregates in its place. Muscovite is a minor component only; in most cases it appears to result from alteration of plagioclase, but it may locally be primary. Epidote is common in chlorite-bearing variants, and locally displays an interstitial habit suggesting that it may have been a primary magmatic phase. Allanite, apatite and sphene are the most visible accessories; zircon is less abundant, and fluorite rare. Garnet has been observed only at the north end of Kidlaluit Island, where the granite also lacks the typical "porphyritic" appearance.

Unit 42 includes a few rock types which do not fit the above description. Very fine grained to fine grained quartz - K-feldspar porphyries are present locally in the main body, and in satellite bodies on the east shore of Kaipokok Bay and Long Island. The body northeast of

Marks Bight is also atypical; it consists of graphic K-feldspar quartz micropegmatite that appears to form a network of sheets intruding the Upper Aillik Group.

Unit 43: Cape Strawberry Granite

The Cape Strawberry granite is one of the most interesting bodies in the study area, and is the type area for the Strawberry Intrusive Suite defined by Kerr (1988). It corresponds to Unit 29 of Gower et al.,(1982), although they also included the rocks on Manak Island (here assigned to Unit 14). As used in this report, Unit 43 includes the main body at Cape Strawberry, a subsiduary lobe at October Harbour, and exposures on Foxy Island and Double Island. Sill-like granite bodies in the Poodle Pond area are also included . The Cape Strawberry granite clearly intrudes and truncates fabrics in the surrounding Aillik Group country rocks. It is itself undeformed and fresh, and is cut by diabase dykes and sills. This obviously post-tectonic character led to inclusion in the Trans-Labrador batholith in previous reports and available K-Ar ages of 1565 - 1600 Ma (summarized by Gower et al.,1982) appeared to substantiate this view. U-Pb zircon dates in progress as of writing suggest, however, that the granite may be as old as 1750-1800 Ma; If this is so, it implies that the lithologically similar Bayhead (Unit 33), Dog Islands and Tukialik granites (see below) are also of this age.

Unit 43 is dominated by white to pink or orange-red, coarse grained, K-feldspar porphyritic, leucocratic, granite and alkali-feldspar granite with obvious euhedral biotite and accessory fluorite. Most of the unit is homogeneous, but fine grained equigranular variants occur locally around the contacts of the main body, and at Poodle Pond. These are generally pink or buff, locally miarolitic, leucocratic rocks with accessory fluorite. A distinctive grey phase is present in the northeast of the main body, towards Wild Bight. In places this shows a diffuse foliation and ghostly inclusion textures suggesting that it might be a "granitized" Upper Aillik volcanic or porphyry, but in other areas it appears massive

and resembles a fine-grained version of the granite. It is present also as variably digested and diffuse xenoliths in the dominant coarse-grained granite. Internal contacts are visible also in the dominant coarse grained phase, but cannot be traced beyond the confines of outcrops, suggesting that they represent localized chilling effects.

Although there is no doubt that the granite intrudes the surrounding Aillik Group, contact zones are very complex in detail, and vary from clean, sharp contacts to zones of extensive interaction and hybridization that may partially represent altered and granitized country rocks. Xenolith-rich zones are common near contacts, with fragments of fine-grained granite, Aillik Group metavolcanics, and hybrid lithologies. Brecciated zones with a biotite-rich matrix, suggesting volatile exsolution and hydraulic fracturing, are present in xenoliths and in outcrops close to contacts. Alteration, bleaching and pyritization of country rock lithologies are evident, and suggest hydrothermal activity during or after crystallization. Irregular silicified zones, aplites and pegmatites crosscut the contacts. Amphibolitic units near the margin of the October Harbour granite contain skarnoid patches consisting of calcite-diopside-garnet +/- fluorite, and the margin of the granite itself contains a pale green-brown (calcic?) garnet that is probably a xenocrystic phase from assimilation of this material.

Particularily distinctive features are mafic mineral layers with a trough-bedded geometry suggesting cumulate processes. There is also a large (10x10 m) block of rhythmically layered granitoid exposed about 1.5 km south of Strawberry Point. The presence of such features suggests a low viscosity during crystallization of the granite.

In thin section, typical examples consist dominantly of quartz (20-40%), microcline (40-60%), plagioclase (An_{15-25}; 10-35%), biotite and/or chlorite (1-6%). Quartz forms large anhedral mosaics of polygonal grains, or occurs as coarse-grained graphic intergrowths with groundmass microcline. Microcline is a variably hematized coarse patch perthite,

forming phenocrysts up to 5 cm in size, but generally in the range 2-3 cm. Plagioclase is normally a groundmass phase only. Red-brown or deep brown biotite is the most common primary mafic phase, and occurs as subhedral laths up to 7 mm in size with ragged margins. Blue-green hornblende is locally present in relict form, altered to biotite and chlorite. Chlorite is almost invariably present and replaces the biotite along cleavage traces; in some hematized samples, alteration is complete, and biotite is absent. Sphene is prominent in some samples containing relict hornblende. Fluorite is a very prominent minor phase in most samples, commonly showing an interstitial habit, but locally occurring as intergrowths with biotite, chlorite and iron oxides. Euhedral allanite grains are characteristic, and locally reach 3-4 mm in length. They commonly occur at the centers of radiation - induced fracture systems.

Fine-grained phases of the Cape Strawberry granite mostly display a similar mineralogy to the dominant coarse grained granite, although they are more commonly miarolitic and/or graphic in texture. The grey phase in the northeast of the main body is, however, distinctive, in that it contains poikilitic crystals of deep blue amphibole, probably reibeckite or arfvedsonite . The rest of the rock consists of subequal amounts of quartz, microcline and albitic plagioclase, which appear somewhat more recrystallized than is typical for the coarse grained granites. Biotite and fluorite are also present in this lithology. It is difficult to decide if this represents a discrete phase of the granite, or altered and metasomatized Aillik group material.

"Cumulate" zones consist in thin section of euhedral biotite and hornblende crystals, associated with euhedral sphene, allanite and zircon, and intergrown with fluorite and iron oxides. They suggest that fractionation of accessory minerals may have been important during crystallization of the granite.

Unit 44 : Dog Islands Granite

The Dog Islands granite occurs primarily on Dog Island, Iron Island and Burnt Island, and on the adjacent mainland. It corresponds to Units 17 and 18 of Gower (1981). It is very similar lithologically to the Cape Strawberry granite and was assigned to the Strawberry Intrusive suite by Kerr (1988). The contact relations of the Dog Island granite are not known, but quartz-feldspar porphyry dykes which resemble it cut the monzonite and quartz monzonite of Unit 23 on nearby islands. There are presently no other constraints on its age, except that it is post-tectonic. Contacts with Aillik Group volcanic rocks are not exposed

Unit 44 is dominated by white to pink or orange-red, coarse grained, K-feldspar porphyritic biotite granites that are virtually identical to those described above from the Cape Strawberry granite. The unit is, however, more homogeneous texturally, and generally lacks fine-grained phases. Cumulate zones with a trough-bedded geometry are present at the western end of Iron Island. In thin section, both coarse grained granite and "cumulate" zones are identical to equivalent rocks in the Cape Strawberry body.

Two variants of the Dog Islands granite deserve special mention. A syenite to quartz syenite present on the eastern half of Dog Island and on Burnt Island contains only 5-15% quartz, and also distinctive blue amphibole (reibeckite or arfvedsonite), locally displaying a poikilitic habit. A pleochroic, green clinopyroxene, thought to be aegirine-augite, is present in one sample from Dog island. Other mafic phases include green hornblende and biotite, associated with fluorite, zoned allanite and euhedral zircon. The mineralogy is reminiscent of the fine-grained grey phase in the Cape Strawberry granite.

Distinctive feldspar and quartz-feldspar porphyry dykes assigned to the Dog Islands granite cut Unit 23 quartz monzonite on the Adlavik Islands. Quartz, where present as a phenocryst phase, shows rounded and resorbed outlines. Microcline forms subhedral to euhedral laths, locally

containing cores of saussuritized plagioclase and, in one sample, alternating zones of K-feldspar and plagioclase suggesting oscillatory growth. The mafic phases occur as interstitial clots of chloritized biotite, fluorite, opaques and sphene.

Unit 45 : Tukialik Granite

The Tukialik granite underlies an area of approximately 125 km^2 in the eastern Benedict Mountains, and also underlies all of Bear Island. It corresponds to Unit 23 of Gower (1981). The unit abuts against syenomonzonites of Unit 25 along its southern boundary: this contact is interpreted to be the continuation of the Adlavik Brook fault zone in the west, but may be an original contact in the east. To the west, the unit may be physically continous with the generally similar Dog Islands granite. The granite intrudes the Aillik Group east of Tukialik Bay and on the southern corner of Double Island, and is presumed also to intrude the foliated granodiorite exposed around Deus Cape. A generally similar pink granite intrudes rocks of the Cape Harrison Metamorphic suite on Jigger Island and east of Cape Harrison itself.

The Tukialik granite is dominated by fresh, white to pink or red, medium to coarse grained, K-felspar porphyritic, leucocratic alkali-feldspar granite and lesser granite (s.s) containing prominent accessory fluorite. In general terms, it resembles both the Cape Strawberry and Dog Islands bodies, but is richer in K-feldspar, and also tends to be slightly finer grained, and closer to equigranular in texture. A fine-grained equigranular variant is present locally, particularily near the northeastern contact of the body. A quartz-feldspar porphyry variant occurs locally on Bear Island and, in thin section, resembles similar rock types grouped with the Dog Islands granite.

In thin section, typical examples of the coarse-grained variant consist dominantly of quartz (25-40%), microcline (50-70%), plagioclase (An10-25; 10-25%), biotite, chlorite and fluorite (1-5% combined).

Quartz is fresh, interstitial to graphic in habit, and commonly shows a distinct blue colour in hand specimen. Microcline forms euhedral phenocrysts commonly of approximately 1 cm size, consisting of coarse patch perthites with quartz and plagioclase inclusions. The dominant mafic phase is red-brown biotite, which displays less alteration to chlorite than in the Cape Strawberry or Dog Islands Units. Fluorite occurs as an interstitial phase, as inclusions in biotite aggregates, and in thin cross-cutting fracture zones. Some variants contain up to 2% fluorite. Sphene, zoned allanite and euhedral zircon are the most obvious accessory phases.

Unit 46 : Lanceground Hills and Pistol Lake Granites

Unit 46 occurs in two small (<50 km^2) bodies located near Adlavik Bay. These form the type localities for the Lanceground Intrusive Suite, as defined by Kerr (1988). The Lanceground Hills granite is equivalent to part of Unit 26c of Gower et al.,(1982), and the Pistol Lake granite was grouped by these workers with the Monkey Hill granite (their Unit 28a). The compositionally similar Tarun Granite (see below) is also included with this suite. All of these areas appear to be spatially associated with the mafic to intermediate intrusive rocks of Units 21 to 24, which were considered in previous reports to all form part of the Adlavik Intrusive Suite (Kerr, 1986,1987). In view of the ca.1800 Ma U-Pb zircon ages now obtained from units 23 and 24, it is possible that Unit 46 may be of similar age. A dyke of brown quartz syenite that cuts the marginal agmatite of unit 23 at Adlavik Bay resembles Unit 46. The relationship between Unit 46 and the gabbro-diorite of the Adlavik Intrusive suite proper is unknown. The Pistol Lake body is exposed in an inland area, and is in contact with the Aillik group over a distance of 10 km, although most of this distance is obscured by drift. The contact is sharp and intrusive where visible.

Both bodies are dominated by pink to buff or brown, medium to coarse grained, K-feldspar porphyritic quartz syenite, granite and alkali-feldspar granite. Most examples are fresh and massive, although parts of the Lanceground Hills granite display moderate northeast to east-trending foliation. Deep weathering to a brown or yellowish rubble is characteristic of parts of the Lanceground Hills granite. This characteristic is also developed in the syenite and quartz syenite of Unit 24, which parts of the Lanceground Hills granite resemble.

In thin section, typical fresh examples consist dominantly of quartz (5-35%), microcline (50-80%), plagioclase (An_{10-25} ; 0-25%), hornblende and biotite (0-10% combined). Quartz is fresh, locally blue in colour, and displays an interstitial habit in the freshest samples. Microcline forms phenocrysts of very coarse string perthite, readily visible to the naked eye in stained slabs. Relict simple twinning is present in many samples. Some examples of this unit are effectively hypersolvus granites, as they contain no discrete plagioclase outside of perthite lamellae. Others, however, contain minor groundmass plagioclase, and plagioclase phenocrysts, usually with a wide mantle of K-feldspar around them, are present in a few samples.

Unit 46 contains an interesting assortment of mafic and minor phases. An intense red-brown biotite is the most common species, and in relatively melanocratic variants, is accompanied by blue-green hornblende, locally displaying a poikilitic habit. A few samples also contain small quantities of an intense blue amphibole (arfvedsonite or reibeckite). Locally, hornblende crystals contain relict green aegirine or aegirine-augite clinopyroxene. A red-brown prismatic phase (aenigmatite?) is associated with the aegirine-amphibole clots. Amorphous iron-oxide - hydroxide clots in a few samples contain relict fragments of a highly birefringent phase interpreted to be fayalitic olivine.

Minor phases include interstitial fluorite, prominent allanite intergrown with mafic silicates, apatite, sphene, and distinctive euhedral zircons up to 2 mm in length.

Unit 47 : Tarun Granite

The Tarun granite occurs in an inland area between White Bear Mountain and the Benedict fault zone. It corresponds with part of Unit 26c (Tarun Syenite) of Gower et al (1982). Kerr (1988) assigned the Tarun granite to the Lanceground Intrusive Suite. Correlation is complicated by the foliated and recrystallized nature of the Tarun granite, which lies in close proximity to the Benedict Fault zone. Undeformed examples are pink or buff, coarse grained, K-feldspar porphyritic granites that resemble Unit 46; Geochemical characteristics are similar for most of the unit. Relict aegirine-augite or fayalite have not been recognized in the Tarun granite; however, the distinctive red-brown phase associated with these minerals in Unit 46 is present in some samples. Prominent euhedral allanite and zircon are also a characteristic of this unit.

Unit 48 : Unnamed at present

Unit 48 occurs southwest of Stag Bay, between the Benedict fault system and another prominent east-trending fault system mapped by Gower (1981). It is thus in fault contact with units 31 and 35 to the north, and with unit 50 (Grenville Province granitoid gneisses) to the south. The eastern and western contacts are poorly exposed and of unknown character.

In field appearance, unit 48 is distinct from those that surround it. It is dominated by grey to buff or pink, coarse to very coarse grained, K-feldspar porphyritic quartz syenite, granite and alkali-feldspar granite. It appears massive and undeformed, and is characterized by distinctive interstitial blue quartz.

In thin section, typical examples consist of quartz (10-20%), microcline (50-75%), plagioclase (0-30%), pyroxene (0-5%), hornblende and biotite (5-12% combined). Microcline forms large (up to 5 cm) phenocrysts with both simple and polysynthetic twinning, and zoned plagioclase phenocrysts are locally present. local clinopyroxene is a green relict phase, lacking obvious pleochroism, that displays alteration to amphibole and a red-brown phase. It may be aegirine-augite. Hornblende

has a blue-green colour, and occurs in medium-grained polygonal aggregates associated with biotite. Sphene, apatite and zircon are the most obvious accessory phases.

Unit 48 may be related to the granite to alkali-feldspar granite of Unit 31; it is similar to it in some respects.

2.6.4 GRANITOID GNEISSES OF THE GRENVILLE PROVINCE (Groswater Bay Terrane)

Unit 50 ; Foliated Granitoids and Granitoid Gneisses

South of the Benedict fault zone, all rocks exhibit moderate to intense east-trending foliations attributed to Grenvillian deformation, and many are gneissic in appearance. They are here grouped together as unit 50, although subdivisions can be recognized locally. The portion of the Grenville Province immediately to the south of the Benedict fault zone is termed the Groswater Bay Terrane by Gower and Owen (1984).

The northern boundary of Unit 50 is the Benedict Fault zone itself, recognized initially as a major structure by Stevenson (1970). In the west of the study area, the fault zone is described by Bailey (1979) as a broad zone of mylonitization displaying a subvertical lineation. The zone is well exposed in Big River, where it appears to be a composite feature consisting of a broad zone of intense deformation (up to 1 km in width) within which occur a number of mylonite zones, dipping at 40-700 S, and displaying a steeply plunging lineation. Gower (1981) presents a similar description of the Benedict Fault zone in the Benedict Mountains.

South of the main fault zone, a number of similar structures are present within Unit 50 in the form of discontinous cataclastic and mylonitic zones. There are also fine-grained, strongly foliated granitoid gneisses that occur as conformable layers within coarser granitoids; these are also interpreted as mylonitic in origin . The overall pattern of mylonite zones within Unit 50 is interpreted to be an anastomosing one, similar to that seen in many hand specimens with relict porphyritic

textures. Gower (1981) suggests that this pattern reflects non-localized heterogeneous strain, rather than a strongly localized pattern of ductile strain zones.

Unit 50 granitoid gneisses appear locally to show some relationship to the rock types which lie to the north of the Benedict fault zone. For example, in the area south of the Big River granite (Unit 31), they consist dominantly of pink or buff, coarse grained, cataclastic to mylonitic, augen-textured gneisses whose composition approximates biotite-hornblende granite or alkali-feldspar granite. Vestiges of pseudorapakivi texture are locally present in the least deformed examples, which resemble moderately deformed variants of Unit 31. A similar relationship was observed by Gower (1981) in the eastern Benedict Mountains, where similarily megacrystic granitoids occur north of the fault. Between these two areas, there appears to be little correlation across the fault zone, and the contrast in deformation state is extreme, suggesting a large vertical displacement. The rocks south of the fault zone in central parts of the area consist of a heterogeneous mixture of two contrasting rock types. Coarse -grained biotite-hornblende augen granitoids display relict K-feldspar porphyritic textures, and characteristically contain blue-green hornblende similar to that seen in Unit 31. The mafic assemblage is variably retrograded to sphene and epidote. These rocks are interspersed with fine to medium grained, equigranular to locally banded, leucocratic, granitoid gneisses containing minor biotite and muscovite. These two variants do not neccessarily represent discrete rock types; Gower (1981) suggests that they may represent variable deformation and metamorphism of a common protolith. In addition to these, Gower (1981) distinguished a strongly deformed augen gneiss of monzonitic to syenitic composition immediately south and north of the fault zone, and also two areas of supracrustal rocks, which he considered to be of volcaniclastic origin. The monzonitic to syenitic granitoid gneiss may be equivalent to parts of Unit 25, which occurs north of the fault in this area.

2.7 MINERALIZATION

This section provides a brief overview of mineralization within the study area that is considered to be of "granophile" aspect, and is drawn mostly from work carried out over the last four years by Dr.D.H.Wilton and co-workers (Wilton et al.,1986; MacDougall and Wilton,1987; Wilton et al.,1987; MacKenzie and Wilton,1987; Wilton and Wardle,1987; MacDougall and Wilton,1988). Some information has also been drawn from data in the Mineral Occurrence Data System (MODS) files for the area (Kerr,1982), and from observations made in the course of this project. A more detailed description will be presented in the final project report.

Mineral occurrences of all types are concentrated mostly in the supracrustal rocks of the Aillik Group, and form a wide array of deposit types, which are difficult to explain via any one genetic model. The most abundant commodities are U, F and Mo, with lesser numbers of base metal and precious metal showings. Gower et al (1982) suggested a rough division of mineral occurrences into four geographic belts which, although all within various parts of the Aillik Group, each exhibit their own characteristics. Belts within the lower Aillik Group near Kaipokok Bay and in the Upper Aillik group between Michelin and White Bear Mountain are dominated by Uranium mineralization, but two belts in the Makkovik area also contain substantial Mo, Cu, Pb, Zn and F. Mineralization in thes belts shows no clear correspondance to particular stratigraphic or structural features within the Upper Aillik Group. Ryan (1977) and Gower et al (1982) speculated that there might be some connection between mineralization in this area and post-tectonic granitoid rocks, and more recent work by Wilton et al (1986) lends considerable support to this hypothesis. Figure 3 shows the distribution of some of the more important granophile mineral occurrences in the area in relation to the distribution of smaller post-tectonic granitoid bodies.

Endocontact Mineralization

Mineral occurrences hosted within granitoids in this area are rare compared to those within the country rocks around their margins (see

below). Nevertheless, they provide important evidence for a link between the granitoid rocks and epigenetic mineralization of similar type in the Upper Aillik Group.

The most spectacular endocontact showings consist of Molybdenite. Heavily disseminated Molybdenite in the form of rosettes associated with pyrite, chalcopyrite and very minor bornite occurs in a fine to medium grained highly miarolitic to vuggy leucogranite on Duck Island, covering an area of some 100 - 200 m^2, although disseminated pyrite occurs all over the island. Grab samples of representative material contained up to 0.5% Mo, but only negligable Pb, Cu, Zn and Sn. Continous exposure of the leucogranite is restricted to the island itself, but a network of fine grained granite dykes, veins and sheets disrupts older granitoids on the mainland up to 2 km from Duck Island. The Duck Island granitoid resembles the Monkey Hill granite in most respects and is interpreted as the upper surface of a small cupola or satellite intrusion of this unit. Very similar, but locally higher grade mineralization is present within the Burnt Lake granite adjacent to it's contact with the Aillik group and covers an area of about 100 m^2. There is little associated pyrite in this showing.

A number of other minor Mo occurrences are shown within granitoid rocks on the mineral occurrence map of the area, but many of these are essentially undocumented. There are also problems with locating these minor showings in the field as their marked locations vary considerably on BRINCO maps, with resultant uncertainty on Mineral Occurrence maps compiled from this data. MacDougall and Wilton (1986) report minor Mo in granitoid bodies at Round Pond which are grouped with the Monkey Hill granite, but no Mo has so far been seen in the main body. Mo is similarily lacking from the main part of the Strawberry Granite, but this unit does contain irregular pyritic zones near its eastern contact which appear to be of hydrothermal origin and contain elevated (25 - 50 ppm versus a background of <5 ppm) levels of Mo. Molybdenite flakes occur in fluorite - bearing pegmatites on the west side of Ford's Bight that resemble the Cape Strawberry granite and are correlated with it.

Minor Cu-Pb mineralization has been recognized in the Dog Island granite on Burnt Island and consists of disseminated chalcopyrite and galena associated with fine grained aplitic veins which cut the coarse grained granite. Grab samples of sporadic mineralization contain up to 2900 ppm Pb and 5000 ppm F, but only 500 ppm Cu and Zn. They also contain 116 g/t Sn. The most intense mineralization is at the margins of the veins, but it is sporadic and low in grade. Other Cu-Pb showings are reported from this unit, and also from the October Harbour lobe of the Cape Strawberry granite (data in MODS files and BRINCO maps).

Other mineral occurrences within granitoid rocks include several zones of anomalous radioactivity, most of which are related to pegmatitic segregations, and the widespread accessory fluorite within some granitoids, and particularily in the Cape Strawberry, Dog Island and Tukialik granites, which contain up to 0.5% fluorine. Vein-type fluorite mineralization is less commmon, but a few small-scale examples (<1 cm width) are present in both these plutons. Cumulate biotite-rich zones in these granites contain relatively high concentrations of Rare-Earth elements (REE), up to 2400 ppm Zr, 400 ppm Y , 1300 ppm La and 1200 ppm Ce. A dyke of fine to medium grained granite near Adlavik Bay, assigned to the Lanceground Hills granite, also contains over 2400 ppm Zr and 160 ppm Y.

Possible endocontact U mineralization within the Makkovikian Melody granite (Unit 12) is suggested by the occurrence of high-grade pitchblende in granitic boulders near Melody Hill itself. Weak U mineralization is present within the granite itself in one location and is associated with intense hematization. A source for the high grade float has yet to be located.

Exocontact Mineralization

The characteristics of a large number of mineral occurrences within the Aillik Group around Makkovik strongly suggest that they are related to

nearby or subjacent plutons. The most obvious and most significant examples are in the Round Pond area, where a large number of gossans and discordant hydrothermal veins appear to be spatially related to two small plugs thought to be related to the Monkey Hill granite (MacDougall and Wilton,1986). The mineral assemblage is polymetallic, comprising Mo,Cu, Zn, Pb, U, F and Ba, with minor W, Ag and Au. C.MacDougall (in prep.) has recognised several different types of vein, including carbonate-hosted Pb-Zn, massive and stockwork-style Py-Cp, quartz-molybdenite and fluorite veins with significant U. Fluorite appears to be a common component of all vein types. Distribution and mineralogy of the Round Pond vein swarm appear to be zoned with distance from the eastern stock of the Round Pond granite, with proximal Mo-Cu and distal Pb-Zn-U-F mineralization. Grades reported by Wilton et al.(1986) range up to 4% Cu, 4% Zn, 2% Mo, 0.5% U and 0.2% Pb, with locally significant Au and Ag enrichment. The characteristics of individual veins vary widely, and most are of lower grade. One sample contains 160 ppm W, but no Sn enrichment appears to be present. There appears to be a structural control on mineralization exerted by the Upper Aillik Group host rocks; most of the veins are hosted by a conglomeratic/agglomeratic unit, whereas recrystallized felsic tuffs intruded by the western stock are apparently unmineralized. MacDougall and Wilton (1988) concluded also that linear to stratiform U occurrences hosted by the Upper Aillik Group in the Falls Lake area are of epigenetic origin and display similar characteristics to the Round Pond mineralization. They consider them to be of granophile association based on the presence of Mo, base metals and F; they are located 6-10 km south of the granite stocks at Round Pond.

A group of similar carbonate-hosted Pb-Zn veins containing significant Ag and Au occur near Big Bight, in close proximity to the October Harbour lobe of the Cape Strawberry granite. These were discovered by BRINCO in 1963, and consist of quartz-carbonate veins up to 1 m in thickness occupying cross-cutting late shear zones in pyritized Upper Aillik Group metavolcanics (Wilton and Wardle,1987). Precious metal grades

range up to 1g/T Au and 387 g/T Ag, and base metal grades from 2-16% Pb and 4-10% Zn. Pb isotope data from these veins (Wilton and Wardle,1987) suggests an age for the mineralization of ca.1530 to 1600 Ma, which is comparable to K-Ar age dates from the granite itself (Wanless et al.,1969), but inconsistent with new U-Pb zircon data suggesting that the granite may be as old as 1800 Ma (Krogh, unpub.data).

Further mineralization which may be spatially related to the Cape Strawberry granite is present in the form of numerous small, low grade Mo showings distributed on the peninsula west of Ford's Bight. Many of these are associated with pegmatites and/or aplites containing Py, Mo and F, and Wilton et al.(1986) report thin (<10 cm wide) carbonate-quartz veins containing galena and sphalerite. Similar low-grade showings and pyritiferous gossans are present around the Southern contact of the Strawberry granite, and locally display a clearly epigenetic style of mineralization. The most significant is the LM-12 showing, where stockwork-style Mo-Py veinlets with some Zn invade the Aillik group close to and (presumably) vertically above the southern contact of the granite, and are associated with pegmatites containing disseminated Mo. Bleaching and alteration of the Aillik group is widespread in the area around this southern contact, and disseminated pyrite is widespread.

In addition to these areas close to discrete, mappable bodies of post-tectonic granite, Wilton et al.,(1986,1987) and Wilton and Wardle (1987) suggest that some of the apparently stratiform Mo-U mineralization hosted by sheared zones on the Aillik peninsula may in fact be of granophile origin, as it is seen in detail to consist of numerous cross-cutting Mo-Py veinlets. The most significant is the Cape Aillik molybdenite prospect, which contains 2 million tonnes of 0.25 % Mo, and is hosted by a stratiform gossan zone within which a stockwork style of mineralization is evident. The geology in the immediate area of the deposit is dominated by Upper Aillik Group metasedimentary rocks, but these are cut by sheets and veins of fine-grained granite that resembles the Monkey Hill granite. Similar conclusions were drawn regarding the

Sunil showing, which lies in the same shear zone, and contains minor Zn, U and F in addition to Mo. Wilton et al.(1986) also report the presence of skarnoid calc-silicate ± fluorite alteration in these showings and a large number of other small discordant Pb,Zn and Mo showings in the general Makkovik area. Skarn development is a very common feature of the Aillik Group in areas proximal to the late granites, where it develops preferentially in reactive compositions such as amphibolites and calcareous metasediments. Skarns in an amphibolite unit near October Harbour also contain abundant fluorite locally.

Outside of the Makkovik area, exocontact mineralization in the Aillik group of possible granophile origin appears to be less extensive. The most probable example is near Burnt Lake, where MacKenzie and Wilton (1986) describe base metal mineralization that appears to be superimposed on an earlier phase of U mineralization. REE patterns from the showings resemble those from similar occurrences in the Makkovik area, suggesting a similar genesis. The most probable source for mineralizing fluids is the Burnt Lake granite, which also contains endocontact Mo (see above). On a broader scale, U-Pb zircon data suggesting the existence of a post-tectonic group of granites of ca.1800 Ma age (Krogh, unpub.data) opens the possibility of a relationship between such rocks and other U mineralization traditionally considered to be of syngenetic or synvolcanic origin, such as the Michelin deposit (e.g. Gandhi,1978; Gower et al.,1982). Gower et al.(1982) suggested that synvolcanic intrusive rocks associated with the Upper Aillik Group may have been important in driving hydrothermal systems; if some of the differentiated post-tectonic granitoids are of similar age to the Aillik Group, they may also have been sources for mineralizing fluids.

The body of evidence outlined above suggests that the differences in the style of mineralization between the Makkovik area and areas further to the west may reflect the role of granitoid-related polymetallic mineralization associated with high-level post-tectonic granitoid rocks in the former area. It also provides direct evidence of further potential in and around these units and others for which prospecting efforts have to date been limited.

3. GEOCHEMISTRY

A primary objective of this project is the recognition of spatial variation patterns that, on a regional scale, define units of potentially specialized granitoid rocks and, on a more local scale, define areas of highest potential within such units. Lithogeochemistry is also a valuable tool in geological mapping of granitoid terranes, as it helps to group intrusive rocks of similar age or petrogenesis. This report is directed mostly towards assessment of spatial variation; details of geochemical trends and comparative geochemistry are discussed elsewhere (Kerr, 1988a, in press).

3.1 INTRODUCTION

Lithogeochemical surveys were carried out in a structured manner. Approximately 1300 samples were collected and analyzed. These fall into three groups :

1. "Regional Samples", collected at approximately 2 km intervals using a regular grid and preselected sample sites (see below). These provide an unbiased view of the abundance and distribution of different rock types within the area.

2. "Follow-Up Samples", collected from localized areas defined by results from regional sampling. Sample sites were preselected at approximately 1 km intervals. These are designed to evaluate patterns <u>within</u> favourable units.

3. "Geological Samples", collected on a routine basis during mapping. These have no predetermined sampling pattern and represent examples of different rock types, unusual or aberrant rock types and mineralized or altered rocks.

These sample populations are distinguished by different numbering systems. Regional samples have 7-digit numbers commencing with 0241 or 0242, follow-up samples with 0248 and geological samples with 0249. They are listed separately in Appendix 1. This report is concerned mostly with results from the regional sampling program; Results of follow-up work will be discussed in more detail in a final project report.

Sampling Methodology

Sampling methodology for both regional and follow-up surveys follows methods commonly employed in geochemical exploration surveys (e.g. Garret, 1983). It is based loosely on methods employed during a similar mapping and sampling project in southeastern Newfoundland (Dickson, 1983). An unbiased, pseudo-random sampling strategy has advantages if statistical data analysis methods are involved, and if the results are to be used in assessing extensive quantities such as the proportions of different rock types.

Areas underlain by granitoid rocks were first divided into a number of grid cells using the UTM grid superimposed on all topographic maps; each cell measures 2 km by 2 km (4 km^2). Each cell was further subdivided into 16 smaller cells measuring 0.5 km by 0.5 km (0.25 km^2). One of these cells was then selected on a random basis for the sample site. Where grid cells straddled a contact between different units, one sample site was selected on each side of the contact.

In the field, the first point examined from the air was located at the centre of the chosen 0.5 km by 0.5 km cell; the rock sample was collected as close as possible to this location. Search for outcrop was conducted in an outward pattern from the preselected location until a suitable site was located. In practical terms, the final determinant of sample location usually became the presence of a topographic marker such as a small pond, river channel or swamp, or (in wooded areas) the presence of a landing spot. Strenous efforts were taken to avoid sampling prominent topographic highs such as hilltops unless they were specifically preselected. In areas

of relatively good exposure, this method worked effectively: it was less effective in poorly exposed zones, where often only one outcrop was present in a 2 km by 2 km grid cell. In these areas the original grid pattern was adhered to for spacing control, but sampling cannot strictly be regarded as random.

Rock samples consisted of 6 to 8 kg of fresh material ; a special effort was made to collect large samples of coarse grained or strongly porphyritic rock types. Outcrop duplicates were collected on a routine basis (approximately 1 in 20 samples) from sites separated by 1-5 m. In cases where outcrops contained more than one phase, two or more samples were collected, and estimates made of the relative abundance of different components. Weathered material was mostly removed on the outcrop to minimize contamination. Final cleaning and rejection of unsuitable material with veins, xenoliths etc was carried out at base camp. In most cases the sample was reduced on the outcrop to a size (~5 cm maximum dimension) suitable for direct processing in the jaw crusher. A 0.5 to 1 kg sample was retained for slabbing and staining, and a small chunk retained for thin sectioning. All samples were coded using a numeric coding form (see appendix) to describe physical features such as colour, grain size, texture and mineralogy. Density and magnetic susceptibility were measured for regional samples collected in 1987.

Analytical Program

All samples were processed with a jaw crusher, split repeatedly to produce a representative aliquot, and then powdered using a ceramic ring bowl mill to avoid contamination by tungsten carbide. Major elements were determined by atomic absorption spectrometry (AAS by titration) in the laboratories of Rhine Laboratory. Loss on ignition (LOI) was determined by heating samples to 1000 °C and measuring weight loss.

A range of trace elements were determined at the laboratories of Rhine Laboratory using the following methods:

Ga, Nb, Zr, Th, Y, La, Ce -- Inductively Coupled Plasma (ICP) Spectroscopy

Be, Cu, Zn, Pb, Sr, Ni, Li, Rb, Cr, V, Mo, Be, Co, Ag -- Atomic Absorption (AA) Spectrometry.

F -- Ion Selective Electrode (ISE) method.

A number of additional trace elements were determined under external contract. U was determined for all samples by Instrumental Neutron Activation Analysis (INAA) by Nuclear Activation Services of Hamilton, Ontario. A subset of approximately 600 samples (representing most of the differentiated granitoid rocks and a random selection of other units) were selected and analysed using a multi-element INAA package by Bondar-Clegg Ltd of Ottawa, Ontario. This included the following elements:

Na, Sc*, Cr, Fe, Co, Ni, Zn, As*, Se, Br, Rb, Zr, Mo, Ag, Cd*, Sn, Sb*, Te, Cs*, Ba, La, Ce, Sm*, Eu*, Tb*, Yb*, Lu*, Hf*, Ta*, W*, Ir, Au*, Th, U

Elements marked with an asterisk proved to be useful; others are useful mostly as a cross-check with AA or ICP data, or have detection limits which are too high to be useful in real geologic situations. The same group of samples were analysed for Sn by X-ray Fluorescence (XRF) spectrometry by Bondar-Clegg.

Accuracy and Precision

Table 1 lists detection limits for major and trace elements determined at the Department of Mines Laboratory, and also detection limits suggested by Bevenguard (1987) for elements determined by multi-element INAA using lake sediment media.

Accuracy has been assessed by repeated analysis of a number of international and internal standard rock samples, with approximately 1

analysis in 20 representing a control. A compilation of data for selected controls analysed at the Department of Mines laboratory (and also U) is shown in Table 2. Recommended values are currently accepted values from Abbey (1979) or recent issues of Geostandards News. There is good reproducibility for all elements, with the possible exception of Ce by ICP spectroscopy, which appears to be anomalously low for some standards. Ni and Cr values are also slightly depressed from recommended values. Comparable data for external multi-element INAA analysis have not been compiled as of writing; however, a compilation of lake sediment data by Davenport (1987) is applicable in most respects.

Precision has been assessed via regular analysis of sample splits (approximately 1 sample in 20 is a duplicate). Precision is expressed as a percentage value computed from the ratio of the difference between duplicate analyses to their mean (P = ABS (V1 - V2) * 100 / MEAN (V1,V2)). A compilation of precision data for elements analysed at the Department of Mines Laboratory (also U) is shown in Table 3. Mean values do not provide a good measure of "average" precision as they are strongly biased by inclusion of outlying poor analyses; in addition, precision values for trace element data commonly show strongly log-normal frequency distributions where high values represent determinations at or near the detection limit. The 50th percentile value (MEDIAN) and the 75th percentile value are better measures of precision for these elements. It should be remembered that for elements showing low concentrations (e.g. Mo, Sn), the low levels and integer values reported cause artificially poor precision.

Comparable data for external multi-element INAA data have not been compiled as of writing; however, a compilation of lake sediment data by Davenport (1987) is applicable in most respects.

3.2 GENERAL GEOCHEMICAL PATTERNS

Intrusive rocks sampled during this project cover almost all of the igneous spectrum. They are, however, dominated by granitoid rocks falling

in the IUGS fields of monzogranite and granite (s.s), and displaying high SiO_2 contents in the range 70-80%. Histograms for selected major element oxides (Figure 4) confirm the dominance of such rock types in the study area. Table 4 lists univariate statistical breakdowns for all of the units discussed in the preceding chapter. Mean and standard deviations provide a good measure of central tendency and variance for most major and some trace elements, and minimum and maximum values provide an indication of extreme compositions. The median, representing the 50th percentile value, is also listed for all units comprising more than 10 samples. For some major elements, and for most trace elements, this provides a more realistic indication of "average" compositions, as it is essentially unaffected by high or low outlying values.

Characteristics of "specialized" granites

Granitoid rocks associated with metallic mineralization commonly display geochemical characteristics which distinguish them from the greater population of barren granitoids. A number of different characteristic features have been proposed for such "specialized" granites (e.g. Tischendorf,1977; Strong,1981; Isihara,1981; Taylor and Strong,1985). Criteria that emphasize absolute levels of (particularily) trace elements are difficult to apply rigorously as the levels of such elements depend on both source compositions and the differentiation processes that subsequently affect a magma. In this study, specialization is thought of as a relative characteristic, and defined in terms of regional background compositions exemplified by average compositions for regional granitoid units. However, this definition corresponds in general terms to those suggested for other areas (e.g. Tischendorf,1977; Ramsay, 1986). The following generalized definition has been used:

1. Generally high SiO_2 contents (71.5 - 80%), coupled with (MgO + CaO) < 1.5%, and FeO(t) < 1.8%

2. Relatively enhanced levels of F (1000-5000 ppm), Rb (180-500 ppm), Zr (250 - 2500 ppm), Th (15-70 ppm), U (5-20 ppm), and a range of other lithophile trace elements.

3. Relatively reduced levels of Sr (10-160 ppm), Ba (50-400 ppm), V (5-25 ppm), and other compatible trace elements.

4. Relatively low K/Rb (50-200), high Rb/Sr (2-15), low Ba/Be (20-100) and low Ba/Rb (0.25 to 4) ratios.

5. Disorganized trace element behaviour, characterized by extreme variance and a lack of correlation between trace elements and major element variation due to mineralogical variation caused by fractionation.

6. Direct or spatial association with mineralization and/or alteration (this over-rides the above chemical criteria).

Units within which a majority of samples fit a majority of these characteristics are considered to be specialized in terms of their regional environment. The above description applies well to those plutons which are known to host or be associated with mineralization, and provides a reasonable guide for recognition of similar rocks. The trace element characteristics listed above are not uniformly developed in different units, and provide the basis for distinction of three suites of specialized granitoid intrusions (Kerr, 1988a). The geographic groupings defined by this method do, however, include individual samples or areas that do not strictly meet these criteria.

Assessment of Individual Units

Examination of the mean compositions listed in Table 4 suggests that the following units meet some of the criteria listed above.

Foliated granitoids :

Unit 11 (Kennedy Mountain granite)
Unit 15 (Pitre Lake granite)

"Mafic and intermediate rocks" (post-tectonic) :

Unit 25.3 (Syenite to granite of Mount Benedict suite)

Smaller Plutons (post-tectonic):

Units 40 and 41 (Witchdoctor and Burnt Lake granites)
Unit 42 (Monkey Hill granite)
Unit 43 (Cape Strawberry granite)
Unit 44 (Dog Islands granite)
Unit 45 (Tukialik granite)
Unit 46 (Lanceground Hills and Pistol Lake granites)
Unit 47 (Tarun granite)

In addition to these groupings, units 31.2 (part of the Big River granite), Unit 33 (Bayhead granite) and Unit 12 (Melody granite) are marginal in composition. In terms of the criteria outlined above, the small Pitre Lake granite displays the most differentiated composition, followed by Unit 25.3 in the Benedict Mountains. The small plutons clearly form the most widespread group of evolved post-tectonic intrusive rocks; most of them fit the criteria outlined above for specialization, and they

include all the known mineralized granites. Kerr (1988a) subdivided these plutons into three compositional groups, termed the Monkey Hill, Strawberry and Lanceground intrusive suites. Table 5 Shows mean compositions for these suites. The Monkey Hill suite, comprising the scattered intrusions of Unit 42, and units 40 and 41, is characterized by relatively low levels of F, Zr, La, Ce, Y, Nb, Hf and REE (Table 1). In contrast, the Strawberry suite (comprising the Cape Strawberry, Dog Islands and Tukialik granites, and probably also the Bayhead granite), shows significant enrichment in these elements. The Lanceground suite (comprising the Lanceground Hills, Pistol Lake and Tarun granites) shares this F enrichment, and displays a greater enrichment in Zr, La, Ce, Y, Nb, Hf and REE. Levels of U, Th, Rb, Ba and Sr are broadly comparable amongst all three groups. The syenite and granite unit of the Mount Benedict suite was not discussed by Kerr (1988a), but its composition is different from all of the above, with higher Rb, Cs, U, Th and Zr, yet lower La, Ce, Y and Hf. The F content is comparable to that of the Strawberry and Lanceground suites. The informal suite names are used extensively throughout the following section.

Data for Upper Aillik group rocks (undivided, but dominated by volcanic and pyroclastic rocks of Unit 3.2 and subvolcanic intrusive rocks of Unit 3.3) shows a general similarity in composition to the smaller post-tectonic granites and also to some units (in particular Unit 11) within the foliated granitoid assemblage.

3.3 REGIONAL SPATIAL GEOCHEMICAL VARIATION

The large, systematic geochemical database accumulated during this project allows the examination of spatial geochemical variation at a variety of scales. This provides a better assessment of the characteristics of particular units than examination of average compositions, and also allows variation within units and between spatially discrete components of the same unit to be assessed.

Regional geochemical patterns are best assessed using the regional sample population collected using a 2 x 2 km grid pattern (see above).

Presentation Methods

Spatial variation is illustrated by a series of 1:250,000 scale proportional symbol maps accompanying this report, where the size and shape of the symbols is proportional to the concentration of the element at that sample locality. In order to provide a more striking visual assessment of geochemical patterns, they are represented also by a series of block maps available as colour transparencies. The production of these maps required some aggregation and/or editing of the original data; blocks containing 2 or more samples are represented by arithmetic means if the samples are of similar lithology or from separate localities, or are represented by the dominant rock type where two radically different compositions were collected from the same spot. Topographic features (coastline, major lakes), and a series of major faults are shown on both media for geographical and geological reference purposes. The colour maps are intended purely as visual aids; the hardcopy maps should be employed for reference purposes.

3.3.1 MAJOR ELEMENT VARIATION PATTERNS

Although major element patterns for granitoid rocks are a less sensitive indicator of specialization than trace element variation, they provide a basis for interpreting such patterns, and also help to confirm unit distributions outlined using field characteristics.

Silica

Silica (SiO_2) is the most commonly used indicator of igneous differentiation. Prominent "highs" exist over parts of Unit 11, and also over most of the smaller post-tectonic plutons. All of these areas lie within the upper 20% of the data (> 80th percentile, 73.0%), and no distinction can be made between them on this basis. Within Unit 11, the northern and southern bodies show markedly higher values compared to the central body at Makkovik Bay, which lies mostly below the 65th percentile.

The syenites and granites of the Mount Benedict area (Units 25.2, 25.3) are not strongly silicic. Most other units are dominated by silica contents below the 50th percentile value, although parts of the Bayhead granite (Unit 33) and also Unit 31.2 show local high values. The mafic and intermediate rocks of the Adlavik Intrusive suite and nearby areas form prominent lows separated and displaced by the Adlavik Brook fault zones. Scattered low values in the south of the area represent isolated hilltops composed of Michael gabbro.

Titanium

Titania (TiO_2) shows a pattern that is in many respects an inverse of the SiO_2 distribution. The Adlavik Intrusive suite and spatially associated rock types form prominent highs, as does Unit 10 (Long Island quartz monzonite). Unit 11 and most smaller post-tectonic granitoid bodies form lows (<35th percentile value, 0.29%), whilst the syenite and granite of the Mount Benedict area falls between these extremes.

Aluminum

The distribution of Alumina (Al_2O3) resembles that of TiO_2. Unit 11 and smaller post-tectonic granitoids form lows below the 35th percentile value (13.85%), whereas the Adlavik suite and associated rock types form highs. The contrast between the three bodies of Unit 11 is visible, and a similar contrast appears to be present between the Monkey Hill and Burnt Lake granites, which show slightly higher values than other smaller plutons. Parts of the Mount Benedict suite show high values (>65th percentile, 15.46%).

Iron and Magnesium

Iron (FeO) and Magnesia (MgO) show very similar distributions. They highlight the Adlavik suite and associated rock types most strongly, and form lows over Unit 11 and smaller granitoid plutons. Both highlight the trace of the fault along the Big River valley very strongly. MgO shows the strongest depletion over the smaller plutons, and appears mildly depleted over the Benedict Mountains area. The FeO pattern is more varied; whilst

the Monkey Hill and Witchdoctor-Burnt Lake granites show strong depletion, the patterns over other small granitoid plutons are more variable. The Cape Strawberry and Dog Islands granites show moderate FeO contents between the 35th and 65th percentile values (1.25-2.48%). The Mount Benedict area shows no distinct pattern.

Calcium

The pattern for Lime (CaO) is similar in most respects to the pattern for MgO. The Adlavik Suite and associated rock types are emphasized, whereas smaller post-tectonic granitoids are depleted. The fault along Big River valley is clearly defined.

Sodium

Na_2O shows only a small amount of variation in the study area. Its spatial distribution is difficult to interpret, as low values may be associated with either low SiO_2 or high K_2O values. Significant highs are present throughout units 23 and 24 on the Adlavik Islands, but are less apparent in the inland area underlain by these rocks. Most of the smaller granitoid plutons show low values, reflecting higher K_2O contents, but some (in particular the Monkey Hill granite) show moderate enrichment to levels beyond the 65th percentile (4.32%). The strongest depletion occurs over gabbros of the Adlavik Intrusive suite. Na_2O is enriched in the large area underlain by the Big River granite (Unit 31), and is strongly enriched in the syenites and granites of the Mount Benedict area, which is defined very clearly, particularily in the western part, where most of Unit 25.3 occurs.

Potassium

Although Potash (K_2O) might be expected to show an inverse of the Na_2O pattern, it does not. The most prominent lows are associated with gabbroic rocks of the Adlavik Intrusive suite. Prominent highs are associated with parts of the Adlavik Islands (Units 23 and 24), with the

northern part of The Big River granite (Unit 31), and , most obviously, with the syenites and granites of the Mount Benedict area. Amongst the smaller granitoid plutons, those of the Strawberry and Lanceground Intrusive suites show enrichment, whereas the Monkey Hill granite and parts of unit 11 are mostly below the 50th percentile level (4.93%).

Phosphorus

The pattern for Phosphoria (P_2O_5) is similar to those shown by TiO_2, MgO and CaO.

A/CNK Ratio

The A/CNK ratio, calculated as the ratio between molecular Al_2O_3 and the molecular ($CaO+Na_2O+K_2O$), is a parameter that has been used extensively in assessment of granitoid rocks. A variant of this ratio forms the basis for the I-S ratio used by Chappell and White (1974) to discriminate between I-type (igneous protolith) and S-type (sedimentary protolith) granites. Samples with A/CNK > 1 are "peraluminous" (i.e. excess alumina), and are often characterized by aluminous minerals such as garnet or muscovite. The distribution pattern for A/CNK suggests that most of the rocks have A/CNK < 1.0 and are thus metaluminous in composition. Exceptions to this pattern occur in several areas. The Melody granite (Unit 12) is distinguished from all other foliated granitoids by its peraluminous composition. Amongst the smaller granitoid plutons, The Monkey Hill and Witchdoctor-Burnt Lake granites are also of peraluminous composition, and contrast with the granites of the Strawberry and Lanceground suites, which are dominantly metaluminous, as are the syenites and granites of the Benedict Mountains.

Agpaitic Index

The agpaitic index is the ratio of molecular (Na_2O+K_2O) to molecular Al_2O_3, and is a measure of alkali saturation, or "alkalinity" in igneous rocks. Rocks with AI > 1.0 are "peralkaline", and

are often characterized by sodic mafic silicates such as aegirine or reibeckite. Rocks with high AI values correspond in a general sense with so-called "A-type" granites (Collins et al.,1982; Whalen et al, 1986).

The spatial distribution of AI values highlights two principal groups of rocks; the foliated granites of Unit 11 , and the smaller post-tectonic intrusions of the Strawberry and Lanceground intrusive suites. All of these units show AI values in excess of 0.95, and contain a few samples that are technically peralkaline. The syenites and granites of the Mount Benedict area also show some tendency towards alkalinity. The Monkey Hill granite is slightly depleted (<0.9), whereas the Witchdoctor and Burnt Lake granites show more varied patterns. Gabbroic rocks of the Adlavik Intrusive suite form prominent lows.

3.3.2 NORMATIVE PARAMETERS

The distribution of normative parameters can be regarded as summaries of major element trends. The distributions of individual normative minerals such as quartz, orthoclase, albite and anorthite are almost identical to those of their major cations. However, composite parameters such as the differentiation index provide a better measure of fractionation than the distributions of single oxides such as SiO_2.

Normative Diopside

The distribution of normative diopside resembles those of MgO, CaO and FeO, but is distinct from all of these. Prominent highs exist over all units in which pyroxene is, or was a modal component, in particular the Adlavik Intrusive suite and associated rock types. Most of the smaller granitoid plutons and Unit 11 are defined by lows, but the Lanceground intrusive suite granites, and parts of the Tukialik granite, show values up to the 65th percentile (1.98%).

Differentiation Index

The Thornton-Tuttle differentiation index (TTDI) is calculated as the sum of normative quartz, albite, orthoclase and feldspathoids. It is

therefore a measure of both silica content, alkali content and leucocratic tendencies, and provides a better measure of major element fractionation than SiO_2 alone.

TTDI provides a striking indication of most of the units listed above as meeting at least some of the criteria for specialized granites. Unit 11, and all of the smaller granitoid plutons except Unit 48, are indicated by strong anomalies above the 65th or 80th percentile values (91.1 and 93.8%). The granites and syenites of the Mount Benedict area, which are not highlighted by SiO_2 patterns, are pinpointed by an widespread anomaly of similar magnitude.

Anomalously low areas defined by TTDI also suggest some interesting contrasts. For example, the Adlavik Islands (Units 23,24) are characterized by intermediate values in the 35th to 50th percentile range (82.4 to 87.6%), whereas their equivalents in the Big River valley are almost all below the 35th percentile. Regional granitoid units, and most of the foliated granites , show intermediate values.

Colour Index

The colour index is complementary to the differentiation index; it is calculated as the sum of all normative mafic silicates. In most respects, the spatial distribution of this parameter is a mirror image of the TTDI distribution, but lows defined over Unit 11 and smaller granitoid plutons are less consistent in magnitude. The syenites and granites of the Mount Benedict area are not highlighted by a prominent low.

3.3.4 TRACE ELEMENT DISTRIBUTIONS

Trace element patterns provide the best numerical indicators of metallogenic specialization, and are also much more useful than major element parameters as indicators of spatial variation. In view of the large number of trace elements involved in the analytical program, this section is subdivided into four discussions; incompatible elements, compatible elements, elements of indeterminate behaviour and trace element ratios.

Incompatible Trace Elements

Elevated levels of incompatible elements are one of the prime criteria for recognition of specialized granitoid rocks. Incompatible elements can be roughly divided into two main groups. Large-ion lithophile (LIL) elements have large univalent or divalent ions, and are not accomodated in any common rock-forming silicates except possibly micas. A second group consists of the High-field strength (HFS) elements, with moderately sized, highly charged ions, and also the Rare Earth elements (REE) which transcend from incompatible to compatible behaviour, and may be accomodated in some common silicates and also accessory phases such as zircon and allanite. A number of incompatible elements (e.g.Pb, U) are also ore elements. Others, such as F and Li, are difficult to group purely on ionic characteristics, and are arbitrarily included with the LIL elements.

Rubidium (Rb)

Rb is similar to K and substitutes only in the biotite structure and, to a lesser extent, in K-feldspar. It therefore has little choice but to accumulate in residual magmas. The spatial distribution of Rb is very striking. The most obvious feature is a very well-defined anomaly representing the syenite and granite of the Mount Benedict area, particularily west of Tukialik Bay. Obvious highs exist also over most of the smaller granitoid plutons, and also over parts of Unit 11 (Kennedy Mountain granite). The southernmost body of Unit 11, which shows the strongest major element differentiation signature within this unit, is not strongly anomalous in Rb. Similarily, the Big River granite (Unit 31), although moderately siliceous and potassic, is poor in Rb, particularily south of the Benedict fault zone. Areas south of the fault that show strong positive SiO_2 and TTDI anomalies are low in Rb. Similarily, the Tarun granite, close to the Benedict Fault zone, is significantly poorer than the more northerly components of the Lanceground intrusive suite, which have closely similar major element signatures.

[illegible] and parts of India and Sri Lanka. Although not shown on the maps due to the small size, the Asian tube granite (Unit 12) is highly anomalous in U, with a mean value of over 100 ppm. This indicates the abundance of monazite.

Uranium (U)

Uranium is also highly incompatible, and so important ore elements. U mineralization is widespread in the Peninsular area. Usually in association with granophyric elements such as Mo. The distribution of U is closely similar to that of Th. A relatively anomalous area occurs in the Deccan Peninsular area and slightly smaller and more sporadic anomalies occur over most of the eastern post-Archaean granites. Of these, the Pokhabil, Raj Ranjan, Bombay Hill and Surat tube granites show the strongest enrichment (although the Pokhabil granite seems poor in Th). The Gaya Dhanbad granite, and granites of the Jamnagar suite, are moderately anomalous. Most U mineral is a chemical secondary type, and is relatively depleted zones are associated by the intrusion of a fault. This pattern is similar to that seen for Th and Mo.

Lead (Pb)

Lead generally behaves as an incompatible element, but substitutes in K-feldspar and, to a lesser extent, in biotite. The pattern displayed by Pb is dissimilar to that of other U-enriched elements above. It is most anomalous in the Gaya Dhanbad. Pokhabil tube and Raj Ranjan granites, and shows more diffuse and weaker anomalies over most other eastern post-Archaean granites, and also the Bombay Deccanic areas. The Rajasthan granites and parts of Mali in and other anomalies.

Samarium (Sm)

Sm is more incompatible than U, Th and Pb, and exists not as a discrete mineral but substituted in other minerals, e.g. [illegible]. It has been determined only in selected samples by XRF, and data is not available for most granites.

strong anomaly in the Ruwi formation area (thick green-white, 0.8 ppm). There are suggestions of smaller and weaker anomalies over the Lage Sandstone and Rumay Hill granites.

Fluorine (F)

F is an anion, and cannot strictly be viewed as a LIL element. It is a very important incompatible element in that it provides anionic complexes for element transport, and also has a drastic effect on both the viscosity and crystallization temperature of magma. The spatial distribution of F shows a large anomalous area in the Barrenjoey Mountains that corresponds to the Tubbalah granite, and symmetric to granite of units J3.3 and J3.5. Smaller anomalies of equal magnitude are present over the Lage Sandstone, Pittwin Lake, Lenaghans Head and Dog Rocks granites. All of these areas lie above the 600 ppm-contour (1040 ppm). The Seymour granite (lithologically similar to the Barrenjoey intrusive suite), and parts of Unit J3, are also moderately anomalous. In contrast, the Rumay Hill granite does not show a recognizable anomaly, and the Stockyard Gully Lake granites are marked by anomalously low values below the 300 ppm-contour (200 ppm). Moderate and low values are also typical of most of the Big River granite (Unit J5). Fluorine enhances the differentiation of magmatites, since and essential part as apatite is given up; this may account for localized high values within mafic and intermediate rock units.

Strontium (Sr)

Strontium is a LIL element which usually forms a divalent cation (Sr^{2+}), although it can be present in economic ores as sulfate. Strontium is by no typical of many (but not all) anatectic/granitic magmatites, particularly those of appinitic or granodiorite affinity (often associated with Cu-Mo), and I-to weak S-type. It is strongly enriched over the granites and syenites of the Barrenjoey Complex, and also over several of the mafic pre-tectonic plutons.

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notably those of the Strawberry and Lenegrand intrusive suites. The southern portion of Unit II is also strongly anomalous. Granites of the Monkey Hill intrusive suite are marked by values below the 50th percentile, and in some cases by obvious lows. Parts of the Big River granite (Unit III) are moderately anomalous, but the clear separation into a northern and southern component shown by Th, U and Rb is lacking.

Rubidium (Rb)

Rubidium behaves in a similar manner to Sr. The spatial distribution of Rb is closely similar to that of Sr, and highlights essentially the same features. However, the anomaly over the Cape Strawberry granite is of lesser magnitude, whereas the Baynes granite displays a stronger anomaly than for Sr.

Uranium (U)

This LIL element is commonly grouped with Rb and Sr, and has very strong chemical affinities to Sr. Data is available for less than 50% of regional samples, with a bias towards more differentiated rock types. The distribution of U highlights granites of the Lenegrand intrusive suite most strongly, and also shows distinct anomalies over the Big Islands and Ruisseau granites. Moderate anomalies are present over parts of Unit II, other Strawberry intrusive suite granites, and granite and syenite of the River Denaud area.

Thorium (Th)

Although not a rare-earth element, Thorium has strong chemical similarities to the lanthanides, and is an ore element of increasing importance. The spatial distribution of Th is very similar to that of La and Ce, more subtle and highlights most of the same areas. It shows a stronger anomaly in the Baynes granite than either La or Ce.

Lanthanum (La)

La is typical of light REE elements. It is incompatible, but can enter accessory phases such as titanite, zircon and allanite. The spatial

distribution of La shows strong anomalies for small granitoid plutons of the Strawberry and Lanceground intrusive suites. Parts of Unit 11 are also anomalous, as is the Bayhead granite. The Monkey Hill intrusive suite granites are marked by low areas, as are most other foliated and regional granitoid units. The Big River granite (Unit 31) shows a moderate anomaly in the north, and a low over its southern half.

Cerium (Ce)

Ce is a light rare-earth element closely similar to La, and shows a very strong correlation with it. The spatial distribution is essentially identical.

Samarium (Sm)

Samarium lies in the centre of the rare-earth series. Data is available only for less than 50% of the regional samples, and is biased towards more differentiated rock types. The pattern for Sm shows high values over granites of the Strawberry and Lanceground intrusive suites, and also over parts of Unit 11. The syenite and granite of the Mount Benedict area lies mostly below the 50th percentile value (0.9 ppm). Granites of the Monkey Hill intrusive suite show low values.

Terbium (Tb)

Tb is a middle to heavy rare-earth element. Unfortunately, the detection limit for Tb by INAA (1-2 ppm) is too high for realistic definition of regional trends. It does, however, allow anomalous areas to be defined. High values occur over essentially the same areas defined by La, Ce, Y and Sm anomalies, suggesting that the patterns are not simply artifacts of analytical noise.

Ytterbium (Yb)

Yb is a heavy rare-earth element which also has a rather high (0.5-2 ppm) detection limit by INAA. Only strongly anomalous areas can be defined; however, these fall into the same general patterns as La, Ce, Y,

Sm and Tb, suggesting that variation is systematic. The different levels shown by regional (nonanomalous) samples and the syenites of the Mount Benedict area may, however, be an artifact. The latter area was analyzed in 1987, when the detection limit improved from 5 to 2 ppm. This area would have been reported as <5 ppm if analyzed in 1986, and would thus have been assigned the arbitrary "below detection" value of 2.5 ppm.

Gallium (Ga)

Ga is a member of the same element group as aluminum and is closely associated with it. Its behaviour in magmatic processes is neutral to slightly incompatible, but it is commonly enriched in A-type or alkaline-tending granites. The spatial distribution of Ga shows a general resemblance to that of La, Y and REE. However, there is a very prominent depleted zone throughout the Benedict Mountains area, which also includes the Tuktialik granite, which is enriched in REE.

Compatible Trace Elements

A smaller number of trace elements can be regarded as compatible, in the sense that they readily enter the structure of common early-crystallising phases such as pyroxene, amphibole and plagioclase. Many such trace elements are depleted very quickly in residual liquids, and are of little value in assessing and contrasting granitoid suites.

Nickel (Ni)

Nickel is strongly concentrated into early phases such as olivine. It is thus removed very quickly from any residual magma. The spatial distribution of Ni is unidirectional over granitoid rocks; essentially all of these areas lie below the detection limit (5 ppm). Gabbroic rocks of the Batiqvik intrusive suite, and also isolated samples of Nicholai gabbro (both units contain olivine) are defined by prominent highs. There are suggestions of some modest Ni values in the Mount Benedict area, particularly in areas underlain by units 25.3 and 25.5. The latter is interpreted as a plagioclase cumulate, and locally contains olivine. Parts of units 23 and 24 are also above detection limit in the range 5-8 ppm.

Chromium (Cr)

Chromium is likewise highly compatible, entering into pyroxenes and the minor phase chromite. It shows more variation than Ni, but basically suggests the same patterns. There is a large moderately high area in the Benedict mountains, encompassing most of Unit 25 and parts of Unit 45 (Tukialik granite). This is puzzling, although the fact that cumulate lithologies exist within unit 25 may be relevant. Some rocks in this area might be mixtures of cumulus phases and residual magmas.

Vanadium (V)

Vanadium is part of the HFS element group, but a small ionic radius confers compatible behaviour upon it. Strong positive anomalies occur over the Adlavik intrusive suite and associated lithologies, and most of the less evolved granitoid rocks also show middle range values. Smaller post-tectonic granitoids are marked by moderately depleted values.

Copper (Cu)

Most of the observations for Ni and Cr also apply to Cu, and the overall pattern is similar. Although Cu mineralisation is locally present in several areas, none of the known mineralised granites are anomalous in Cu; most of the smaller granitoid plutons lie below the 20th percentile value (3 ppm). The syenites and granites of the Mount Benedict area are the one exception to this rule, as they range up to the 80th percentile value (16 ppm) and beyond. Highest values appear to be associated with gabbro and diorite of Unit 25.1. Mafic rocks of the Adlavik intrusive suite and associated units form positive anomalies.

Scandium (Sc)

Sc is a compatible trace element that preferentially enters amphiboles and pyroxenes. Data are available for less than 50% of the regional samples, with a bias towards more differentiated rock types. The pattern resembles that shown by other compatible trace elements, with maximum highs over gabbroic and dioritic rocks, and lows over most of the smaller

post-tectonic granitoids. Granites of the Strawberry and Lanceground intrusive suites show higher Sc values than those of the Monkey Hill suite and unit 11. Moderately high values are present also in the Mount Benedict area.

Strontium

The divalent alkaline-earth elements Sr and Ba are of particular interest, as they are "large-ion compatible" elements, which experience shifts in behaviour within the general compositional spectrum of granites. Sr is not accomodated by early crystallizing mafic phases, but enters plagioclase feldspar readily. magmas which have fractionated significant amounts of plagioclase will thus show low Sr contents. The spatial distribution of Sr defines prominent highs over rocks interpreted as plagioclase cumulates, in particular the Adlavik Intrusive suite. In contrast, distinct lows are present over most smaller post-tectonic plutons and parts of unit 11. The magnitude of these lows varies somewhat; the most intense are associated with the Lanceground intrusive suite and unit 11, and the least intense with the Monkey Hill granite in its type area. Strawberry intrusive suite granites fall between these extremes. An interesting pattern is present in the Big River granite (Unit 31), which is split into two zones resembling those observed for Rb, U and Th. In this case, however, the polarity is reversed, with lower Sr values in the northern lobe.

Barium (Ba)

Ba also experiences a shift in geochemical behaviour; it becomes a compatible element when K-feldspar crystallizes, but is relatively incompatible in plagioclase feldspar and mafic silicates. It is thus low in early fractionates and late residual liquid, but enriched in magmas that lie in the middle of the granitoid spectrum. The spatial distribution of Ba shows this behaviour very well; it is anomalously high over most of the regional granitoid units, and in other rocks with major element compositions approximating monzonite, quartz monzonite and granodiorite. Gabbroic and dioritic units generally show values below the 50th percentile value (696 ppm).

Most of the smaller post-tectonic granites are also associated with lows, but these are of varying intensity. The most intense are associated with the northern body of Unit 11, and parts of the Cape Strawberry granite and Tarun granite. Other smaller granitoid plutons show more diffuse patterns, but all locally fall below the 20th percentile value (272 ppm). The Benedict fault zone south of Big River also appears to represent a transition in Ba abundance; samples to the south show significantly lower Ba contents. Some of these samples are Michael gabbros, but many are granitoid gneisses of similar major element composition to Unit 31.

Other Trace Elements

This grouping includes a number of trace elements of indeterminate behaviour in igneous rocks, many of which are ore or ore-indicator elements.

Zinc (Zn)

Zinc has many of the characteristics of a compatible trace element, and substitutes readily for Mg and Fe, yet is also commonly enriched in A-type granitoid rocks, and alkaline- peralkaline magmas. Strongly anomalous Zn values are associated mostly with smaller post-tectonic granitoids of the Strawberry and Lanceground suites, but also with syenitic rocks of unit 24, and parts (particularly the southern body) of Unit 11. Granites of the Monkey Hill intrusive suite are characterized by values below the 35th percentile (48 ppm), as is most of unit 25 in the Mount Benedict area. Most regional granitoid units show middle range values.

Arsenic (As)

Arsenic is commonly enriched in mineralized granitoids, and is considered to be a useful indicator for gold mineralization. Data is available only for less than 50% of the regional samples. The pattern of spatial variation is simple and distinctive. The majority of samples are

below the detection limit of 1 ppm, but the syenites and granites of the Mount Benedict area are clearly anomalous (> 80th percentile, 3 ppm). The Cape Strawberry granite, and parts of the Monkey Hill granite, also show lesser anomalies.

Antimony (Sb)

Sb levels are low in all units, and data is available only for less than 50% of the regional samples. The pattern is, however, striking and consistent with that shown by As. A strong anomaly exists in the Mount Benedict area, with a lesser and more sporadic anomalous zone in the Cape Strawberry granite.

Molybdenum (Mo)

Molybdenum showings form the principal expression of granophile mineralization within the area; one might therefore expect Mo distributions to highlight areas of known potential. This, however, is not the case, as the Mo variation pattern is noisy and difficult to interpret. There is some suggestion of a positive anomaly associated with syenites and granites of the Mount Benedict area, but no such patterns can be recognized amongst the smaller plutons, and several (notably the Monkey Hill granite) are associated with distinct lows. Regions of moderately enhanced levels (50th to 80th percentile, 3-6 ppm) are defined by granitoids in the middle of the compositional spectrum (e.g. Unit 10, Units 23 and 24), and also by the northern fringe of The Big River granite (Unit 31), also enriched in Rb, U and Th (see above).

Tin (Sn)

Tin is one of the most important mineral commodities associated with granitoid rocks. Data are available from only less than 50% of the regional samples. A large anomaly is defined over syenites and granites of the Mount Benedict area. Smaller anomalies are present over the Dog Islands granite and the Tukialik granite. Data for the Cape Strawberry granite are also anomalous, but are not well displayed by regional samples (consult Table 6 for summary of data including follow-up samples).

Tantalum (Ta)

Data for tantalum are close to detection limit in most samples, and it is difficult to assess the regional variation pattern. There appears, however, to be some similarity to the pattern for Sn in that the Mount Benedict area forms the strongest anomaly. The Dog Islands and Tukialik granites are also anomalous.

Tungsten (W)

Tungsten data are available only for less than 50% of the regional samples, and most lie at the detection limit of ca. 1 ppm. The only significant grouping of anomalous samples is associated with the Mount Benedict area. Anomalous samples also occur in the Lanceground and Pistol Lake granites.

Trace Element Ratios

Trace element ratios, in particular those that combine elements with contrasting behaviour, are widely used as indices of differentiation. They are able to provide simultaneous measures of enrichment and depletion of indicator elements.

K/Rb Ratio

This is probably the most widely used parameter. In general, K/Rb ratios decrease with fractionation, as Rb accumulates in residual liquids more rapidly than K, which is buffered by K-feldspar crystallization. The spatial distribution of K/Rb shows strong negative anomalies over most of the smaller post-tectonic granitoids, and most obviously over the syenites and granites of the Mount Benedict area. Most of these areas lie below the 20th percentile value (220); lows associated with the Strawberry Intrusive suite and Lanceground suite are less pronounced than those associated with the Monkey Hill suite. The most extensive positive anomalies are associated with the Big Rivergranite (Unit 31), and Units 23 and 24 on the Adlavik Islands.

Rb/Sr Ratio

This is almost an inverse of the K/Rb ratio: the Mount Benedict area and all small granitoid plutons are defined by highs of essentially similar magnitude. Mafic rocks are defined by intense lows, and most of the foliated granitoids and regional granitoid units lie between these extremes. Unit 11 shows high values comparable to those from the small post-tectonic plutons.

Ba/Rb Ratio

The Ba/Rb ratio is a similar parameter to the K/Rb ratio. It shows essentially the same patterns.

Ga/ Alumina Ratio

The ratio of Ga to Al or Al_2O_3 has been widely suggested as an indicator of alkalic or A-type tendencies in granitoids (e.g. Whalen et al.,1987). Ga substitutes for Al, but the feldspar lattice discriminates against it. Thee spatial distribution of Ga/Al_2O_3 highlights the granites of the Strawberry and Lanceground intrusive suites very clearly, with the exception of the Tukialik granite. It also shows a positive anomaly over most of Unit 11, and parts of unit 31. Granites of the Monkey Hill intrusive suite lie mostly below the 50th percentile value (1.13). The syenites of the Mount Benedict area show anomalously low values for this parameter.

4. SUMMARY and DISCUSSION

General Geology

The study area contains a wide variety of intrusive rocks, covering a timespan of 300-400 Ma and ranging in composition from pyroxenite to pegmatitic granite. In general terms, a distinction can be made between those granites that display penetrative, widely developed foliations trending from N to NE in orientation, and generally massive rocks that are only locally foliated and ,where so, show predominantly E trends. In previous reports (e.g Ryan, 1985; Kerr, 1986; 1987), unfoliated post-tectonic intrusive rocks have been assumed to form part of the extensive belt of ca. 1650 Ma intrusions termed the Trans-Labrador batholith (Wardle et al.,1986). This conclusion was consistent with available Rb/Sr and K-Ar geochronological data (see summary by Gower et al.,1982, and Wardle et al.,1986) for most unfoliated granites, and also with the limited U-Pb zircon data available prior to this project. However, it has long been recognized (Ryan, 1985; Gower and Ryan,1986) that there is a considerable compositional overlap between foliated and post-tectonic granitoid suites in this part of Labrador. Recent U-Pb zircon geochronology (Krogh, unpublished data; discussed in chapter 2) suggests that post-tectonic intrusive rocks may fall into two groups of radically different age, and that the magmatic history of the area may be more complex than previously supposed.

The preliminary ca. 1800 Ma ages for the Cape Strawberry granite, and (by inference) other members of the Strawberry intrusive suite implies that some post-tectonic granitoids are actually post-MAKKOVIKIAN intrusions representing post-orogenic to anorogenic magmatism. The ages of the granites of the Monkey Hill and Lanceground suites are unconstrained, although dykes of Monkey Hill-type granite that cut Adlavik Intrusive suite gabbro (the AIS yields an age of 1649 +/- 1 Ma) suggest that at least the former may be younger. Compositional similarities between the Lanceground suite and the Strawberry suite may imply that they are of similar age.

This problem is not restricted to the evolved granitoid suites. The five units (Units 20 to 24) that were grouped by Kerr (1986,1987) to form an expanded definition of the Adlavik Intrusive suite show strong mineralogical and compositional affinities, smooth geochemical trends and a spatial association together in two separate areas. Gabbroic rocks in the Grenville Province to the south (Gower et al.,1987) are similarily associated with monzonite, quartz monzonite and syenite. However, the concordant ca. 1801 Ma ages from units 23 and 24 suggest that they are 150 Ma older than the associated gabbro and diorite, although unit 23 includes an agmatite zone containing numerous gabbroic inclusions previously correlated with the Adlavik Intrusive suite. The syenite and monzonite of these units is thus also a post-MAKKOVIKIAN intrusion, that intruded a post-Makkovikian gabbroic suite of similar aspect to the 1650 Ma Adlavik Intrusive suite.

The dominantly syenitic rocks of unit 25 thus pose a new problem. These have given an Rb-Sr age of 1625 +/- 50 Ma (Brooks,1980), but the possibility that they belong to the older group cannot yet be excluded. Gabbroic and dioritic rocks in Unit 25.1 are very similar to parts of the Adlavik suite (Units 20,21), but it may be unwise to correlate on the basis of lithology alone (see above discussion of units 23 and 24).

In summary, the problem of distinguishing several groups of intrusions with different ages and extensive compositional overlap has not gone away; it has in fact become more serious. Correlations based on lithologic grounds may be invalid, yet remain the only grouping possible in this report. Further U-Pb geochronology , and Rb/Sr and Sm/Nd work, are in progress as of writing, and may help to clarify the problem.

Units showing strongly differentiated or high-level character

Placing the above age uncertainty aside for the moment, geologic mapping and geochemical sampling indicates the existence of a number of intrusive units that appear to represent extensively fractionated granitoid rocks. Some of these have been known for some time,

particularily in the north of the area, but others are new units or new divisions of existing units. The most widespread group of evolved granitoid rocks are those of units 40 to 47 inclusive, referred to in this report as the "smaller granitoid plutons". This term may have outlived its usefulness, as this grouping now includes fairly extensive units such as the Tukialik granite, and could well include rocks of both 1800 and 1650-1600 Ma age. The three compositional groups proposed by Kerr (1988a) may be a more useful classification. Smaller granitoid plutons in the north of the area display evidence of intrusion at relatively high levels in the crust (e.g. sharp intrusive contacts, volatile exsolution, lack of contact aureoles). Granophile mineralization within the area occurs mostly in the north, and shows a strong spatial association with some of these plutons, in particular parts of the Monkey Hill granite and the Cape Strawberry granite.

In addition to Units 40 to 47, strongly evolved granitoid rocks are present in the Benedict Mountains area, particularily around Mount Benedict. These form Unit 25.3; the grouping with mafic and intermediate rocks reflects their partly syenitic composition, and also the association with rock types such as gabbro, diorite and monzonite (Unit 25.1 and parts of Unit 25.2). All of these rocks show distinctive textures, characterized by variably resorbed and embayed plagioclase phenocrysts, and it seems logical to view the syenite and granite of Unit 25.3 as the end member of a fractionated sequence.

Most of the above units are localized in the north of the area, and most lie north of the Adlavik Brook fault zone. Those representatives that are south of the fault zone are associated with areas of local preservation of Upper Aillik group country rocks, suggesting that they represent either higher levels in the crust or at least the upper surfaces of intrusions. This is consistent with the concept of a progressive northward increase in crustal level outlined in the discussion of structural patterns. Large scale geochemical zonation from south to north is evident for a number of chemical parameters, suggesting that the

northern structural blocks contain a higher proportion of evolved granitoids. These observations, and the interpretation of structural patterns described above, suggest that the most fertile territory for exploration lies in the north.

In addition to post-tectonic intrusions, some members of the foliated granitoid group (Units 10-16) show compositions in the granite - alkali feldspar granite range. The Pitre Lake granite is a classic S-type anatectic granite, but the body is of very small dimensions. Unit 11 (Kennedy Mountain granite), which consists of several dispersed bodies, is probably the most interesting, as it is siliceous and fluorite-bearing. It is similar in some respects to the fluorite granites of the Strawberry intrusive suite and (in view of possible 1800 Ma ages from these) may not be much older than them. It is tempting to think of this unit as a deformed and slightly older member of this division.

Regional granitoid units (Units 30 to 34 inclusive) are areally dominant south of the Adlavik Brook fault zone. As a group, they are less differentiated. Parts of Unit 31 have compositions in the alkali-feldspar granite range, and parts of Unit 33 (Bayhead granite) are similar to, but slightly more mafic than granites of the Strawberry intrusive suite.

Geochemical Patterns Indicative of Possible Specialization

Geochemical patterns indicative of possible specialization are best displayed by spatial geochemical variation, and are indicated most dramatically by the patterns for trace elements.

Trace element distributions highlight the syenitic and granitic rocks of the Mount Benedict area most obviously. Relative to regional granitoid units in the area, and also to most of the smaller plutons of units 40-47, this unit is strongly enriched in Rb, Th, Li, U, Cs, F, As, Sb, Sn and W. In terms of major element parameters such as SiO_2, FeOt and (CaO+MgO),

this unit is not particularily anomalous; this is, however, largely a reflection of its syenitic character, as it is clearly anomalous for both Na_2O and K_2O, and is outlined very well by TTDI. Although anomalous in Zr, The Mount Benedict area is not strongly defined by other HFS elements and REE such as Hf, La, Ce, Y, Sm, Tb and Yb, nor by Pb or Zn.

Smaller anomalies of similar or slightly lesser magnitude are present over most of the smaller post-tectonic plutons, with the exception of Unit 48. However, the element associations defined by these anomalies differ considerably. The Monkey Hill, Strawberry and Lanceground intrusive suites each exhibit a distinctive geochemical signature. Although major element patterns overlap extensively, they can be distinguished by contrasts in the major element ratios A/CNK and agpaitic index. For most of the LIL incompatible elements such as Rb, Th, Li, U, Cs and Pb, all three suites display anomalies of similar magnitude. Elements such as Ba and Sr are also depleted to similar levels, except in rocks of the Lanceground suite which show strong depletion of Sr. The syenite and granite of the Mount Benedict area do not show strong Sr and Ba depletion; perhaps as a reflection of their plagioclase-porphyritic nature. For HFS elements and REE, strong contrasts exist between the suites. The Monkey Hill suite is distinguished from the other suites by anomalously LOW F, Zn, Zr, Nb, Hf, Y and REE concentrations. The Lanceground suite and Strawberry suite granites are enriched in these elements, but to differing degrees. Whilst the strongest F enrichment is associated with the Strawberry suite, the strongest REE and HFS enrichment is associated with the Lanceground suite. Both are also anomalous in Sn, although to a lesser degree than the Mount Benedict area.

As mentioned above, the foliated granites of Unit 11 show some petrological similarity to granitoid rocks of the Strawberry suite; They also display similar geochemical patterns, with enrichment in F, Zr, Nb, Y and REE.

Regional granitoid units (30-34) show generally unremarkable patterns of spatial variation; They show neither significant enrichment or depletion in the element suites outlined above. The Bayhead granite (Unit

33) is one exception; this shows geochemical patterns that are similar to, but less intense than those of Strawberry intrusive suite granites. This is consistent with the strong petrological similarity between these units. Parts of Unit 31 (Big River granite) also display slightly anomalous signatures for U, Th, Zr and some other elements. This applies particularily to the northern portion of the unit, in part coincident with equigranular subunit 31.2.

Conclusions and Recommendations

In addition to granitoid plutons that are known to host or bear relation to mineralization, this study has identified a number of other intrusions with similar, or more extreme, geochemical patterns suggesting potential for granophile mineralization. The largest and most anomalous area of such rocks is present in the Mount Benedict area, corresponding to the syenite and granite of Unit 25.3, and parts of Unit 25.2. This comes as something of a surprise, as a number of other units show more fractionated major element compositions. Nevertheless, the magnitude of geochemical anomalies suggests that this area merits further investigation. Known mineralization in the area is restricted to the Jay Lake Mo showing, which may not be in-situ, and some small Mo and F disseminations reported by Gower (1981). The Mount Benedict area has, however, received only minimal exploration and prospecting.

Granites of the Monkey Hill and Strawberry intrusive suites form the next most obvious geochemical target. In their type areas, both units are mineralized. Showings associated in these areas are dominantly of exocontact affinity, suggesting that areas within the Upper Aillik group marginal to contacts are of highest priority. Kerr (1988a) has described geochemical zonation patterns for the Cape Strawberry granite that appear to indicate enrichment of incompatible elements towards the contact. Recognition of such patterns in other granites may be a useful method of pinpointing the most favourable loci for mineralization.

Granites of the Lanceground intrusive suite are not at present known to host mineralization, although a U-Cu-Ag showing may be related to the Pistol Lake granite. The geochemical patterns associated with these intrusions suggest that they are worthy of investigation.

Amongst other units in the area, the foliated granites of Unit 11, and possibly the S-type Pitre Lake granite (Unit 15) merit some further attention, although the small size of the latter suggests that is a very local melt.

Follow up work conducted in 1986 and 1987 is currently under assessment, and will be discussed in detail in a final project report. The purpose is to attempt definition of anomalous sub units and, by using a denser sampling pattern, to look for geochemical zonation patterns within units that may pinpoint the most favourable locations for detailed prospecting.

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FIGURE CAPTIONS

Figure 1. (a) Structural provinces in Labrador and the location of the Central Mineral Belt
(b) Location of the study area and coverage by regional sampling programs in 1985 and 1986.

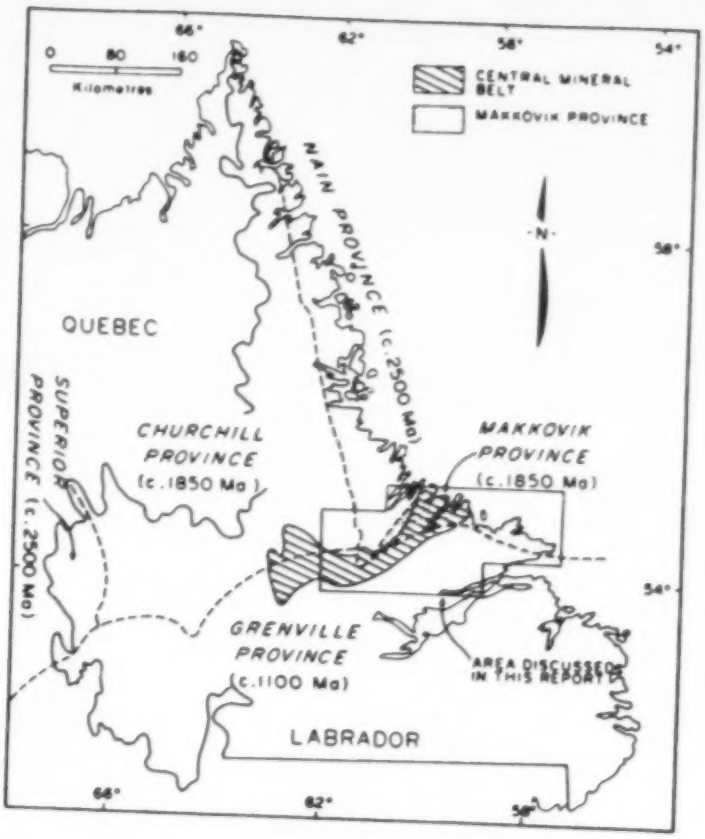
Figure 2. Generalized geological map of the study area.

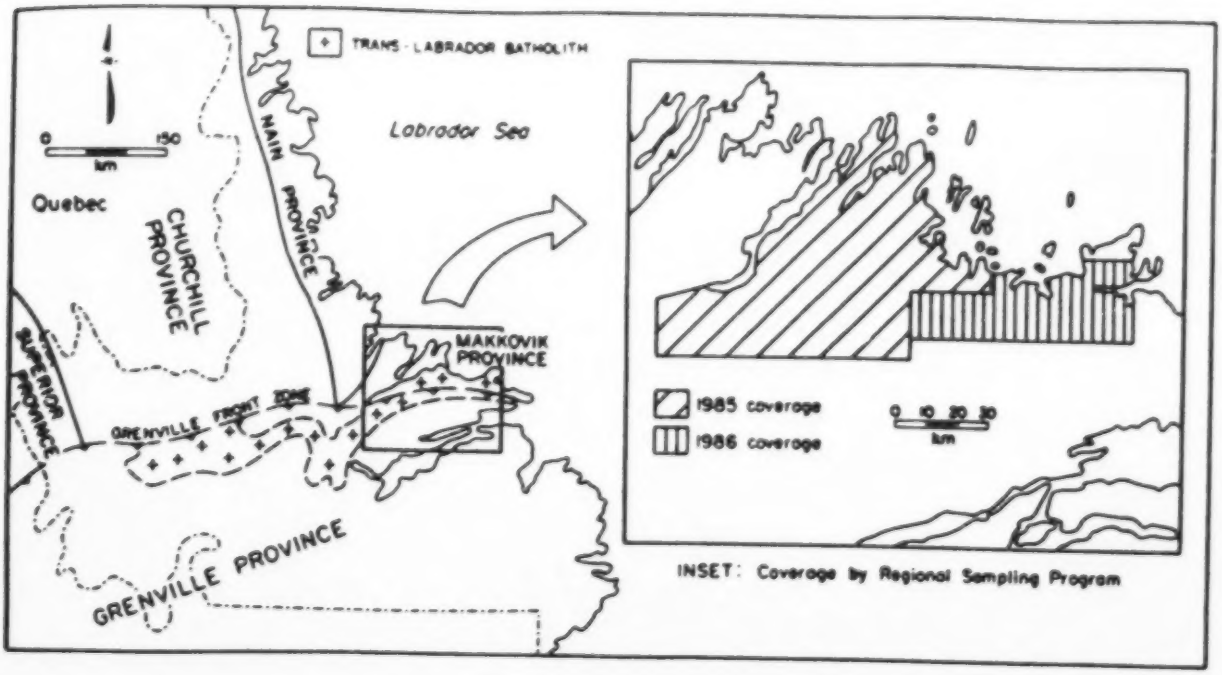
Figure 3. Locations of some of the more important mineral showings considered to be genetically related to granitoid intrusive rocks. Note that unit numbers on this map correspond to those of Kerr (1986, 1987) and not to the numbering system used in this report.

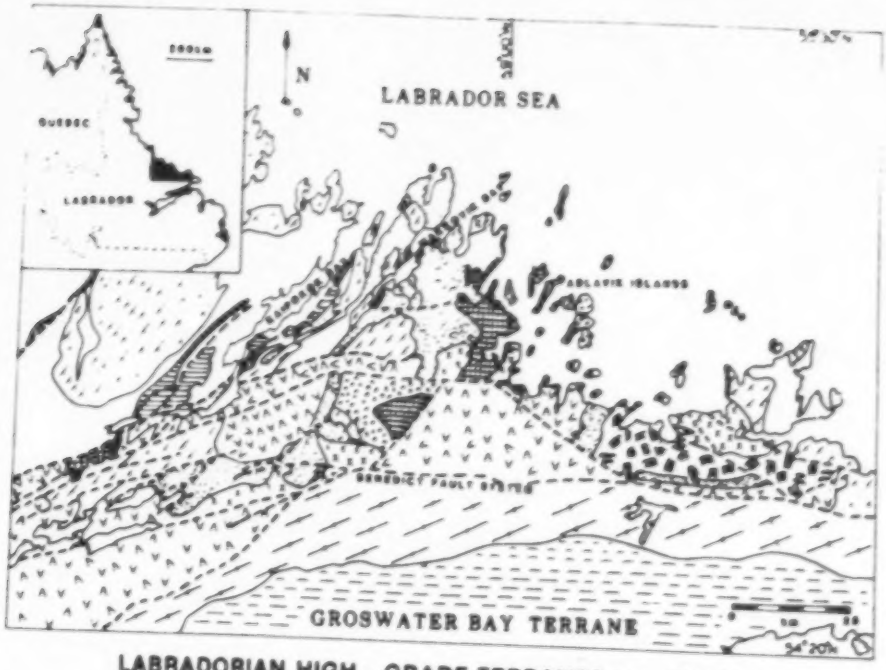
Table 1 . Detection limits for elements at the Dept. of Mines Laboratory

Table 2 . Summary of data for analytical controls analyzed in 1985/86.

Table 3 . Summary of analytical precision for major and trace element data measured at the Department of Mines Laboratory.


66°
62°
58°
54°
0 80 160
Kilometres
CENTRAL MINERAL BELT
MAKKOVIK PROVINCE
N
58°
NAIN PROVINCE (c.2500 Ma)
QUEBEC
SUPERIOR PROVINCE (c.2500 Ma)
CHURCHILL PROVINCE (c.1850 Ma)
MAKKOVIK PROVINCE (c.1850 Ma)
54°
GRENVILLE PROVINCE (c.1100 Ma)
AREA DISCUSSED IN THIS REPORT
LABRADOR
64°
62°
58°


TRANS-LABRADOR BATHOLITH
N
0 150
km
Labrador Sea
NAIN PROVINCE
Quebec
CHURCHILL PROVINCE
SUPERIOR PROVINCE
MAKKOVIK PROVINCE
GRENVILLE FRONT ZONE
GRENVILLE PROVINCE
1985 coverage
1986 coverage
0 10 20 30
km
INSET: Coverage by Regional Sampling Program



LABRADORIAN HIGH – GRADE TERRANES (ca. 1850 Ma)

Groswater Bay Terrane: *Tonalitic and granodioritic gneisses with lesser metasedimentary gneiss. Foliated granitoid rocks.*

POST-TECTONIC INTRUSIVE ROCKS (1800 - 1650 Ma)

Small Granitoid Plutons: *Quartz syenite, granite, alkali-feldspar granite*

Regional Granitoid Units

Foliated and gneissic granitoid rocks affected by Grenvillian deformation

Quartz monzonite, syenite, monzogranite and granite

Monzonite, syenite

Gabbro, diorite

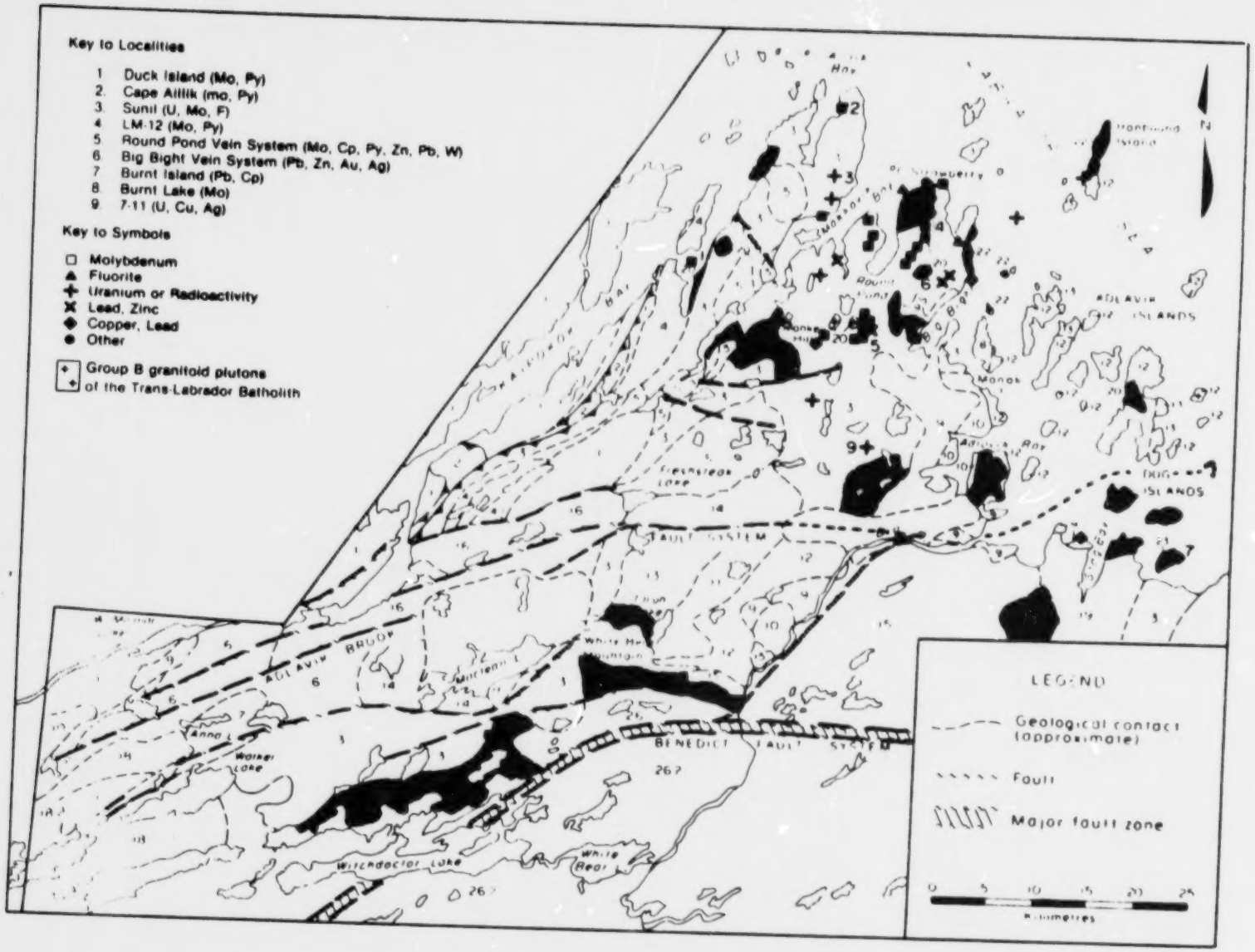
MAKKOVIKIAN – KETILIDIAN OROGEN (2000 – 1850 Ma)

Makkovikian Batholith: *Foliated quartz monzonite to granite*

Upper Aillik Group: *Dominantly felsic volcanic rocks*

Lower Aillik Group: *Mafic volcanics and metasediments*

Reactivated tonalitic basement gneisses of Archean age


Key to Localities
1 Duck Island (Mo, Py)
2 Cape Aillik (mo, Py)
3 Sunil (U, Mo, F)
4 LM-12 (Mo, Py)
5 Round Pond Vein System (Mo, Cp, Py, Zn, Pb, W)
6 Big Bight Vein System (Pb, Zn, Au, Ag)
7 Burnt Island (Pb, Cp)
8 Burnt Lake (Mo)
9 7-11 (U, Cu, Ag)
Key to Symbols
Molybdenum
Fluorite
Uranium or Radioactivity
Lead, Zinc
Copper, Lead
Other
Group B granitoid plutons of the Trans-Labrador Batholith
ADLAVIK ISLANDS
BENEDICT FAULT SYSTEM
WITCHDOCTOR LAKE
WHITE BEAR
LEGEND
Geological contact (approximate)
Fault
Major fault zone
Kilometres

SUMMARY OF MAJOR ELEMENT CONTROL DATA (Dept. of Mines Laboratory)

CONTROL	SIO2	AL2O3	FE2O3*	FEO	MGO	CAO	NA2O	K2O	TIO2	MNO	P2O5	N
AGV-1 (r)	59.61	17.19	6.78	--	1.52	4.94	4.32	2.92	1.06	0.10	0.51	
MEAN	59.24	17.25	6.86	--	1.52	4.88	4.28	2.98	1.06	0.10	0.47	5
S.D.	0.40	0.07	0.10	--	0.03	0.01	0.04	0.06	0.02	.00	0.03	5
BCR-1 (r)	54.53	13.72	13.41	--	3.48	6.97	3.3	1.7	2.26	0.18	0.36	
MEAN	54.25	13.60	13.53	--	3.60	7.00	3.28	1.74	2.28	0.19	0.36	3
S.D.	0.65	0.07	0.21	--	0.05	0.07	0.02	0.02	.00	ERR	0.01	3
BHVO-1(r)	49.9	13.85	12.24	--	7.31	11.33	2.29	0.54	2.69	0.17	0.28	
MEAN	49.74	13.90	12.49	--	7.45	11.43	2.23	0.51	2.80	0.18	0.28	4
S.D.	0.26	0.12	0.22	--	0.11	0.05	0.03	0.01	0.04	.00	0.01	4
DR-N (r)	52.85	17.52	9.70	--	4.40	7.05	2.99	1.70	1.09	0.22	0.25	
MEAN	52.85	17.81	9.63	--	4.36	6.94	2.92	1.70	1.07	0.22	0.24	5
S.D.	0.43	0.14	0.13	--	0.03	0.07	0.05	0.04	0.02	.00	0.01	5
FK-N (r)	65.[illegible]	18.64		--	0.01	0.11	2.58	12.83	0.02	0.01	0.02	
MEAN	65.34	18.82	0.07	--	0.01	0.10	2.54	13.77	0.02	0.01	0.02	5
S.D.	1.11	0.33	0.01	--	ERR	.00	0.04	0.28	0.02	ERR	0.01	5
G-2 (r)	69.[illegible]	15.40	2.69	--	0.75	1.96	4.06	4.46	0.48	0.03	0.13	
MEAN	68.64	15.24	2.60	--	0.76	1.90	4.10	4.54	0.49	0.04	0.13	4
S.D.	0.48	0.14	0.03	--	.00	0.02	0.01	0.07	0.01	.00	0.01	4
GS-N (r)	65.98	14.71	3.71	--	2.31	2.51	3.78	4.64	0.68	0.06	0.28	
MEAN	65.55	14.66	3.70	--	2.25	2.43	3.76	4.68	0.65	0.06	0.40	5
S.D.	0.64	0.22	0.06	--	0.02	0.02	0.03	0.02	0.03	0.01	0.23	5
GSP-1 (r)	67.32	15.28	4.30	--	0.97	2.03	2.81	5.51	0.66	0.04	0.28	
MEAN	66.83	14.97	4.27	--	0.97	1.98	2.79	5.58	0.66	0.05	0.27	6
S.D.	0.56	0.13	0.06	--	0.01	0.04	0.03	0.11	0.02	.00	0.04	6
MAG-1 (r)	51.19	16.46	6.98	--	3.13	1.38	3.91	3.72	0.75	0.10	0.18	
MEAN	51.15	16.65	7.18	--	3.16	1.41	3.92	3.51	0.72	0.11	0.15	4
S.D.	0.08	0.14	0.08	--	0.03	0.01	0.02	0.08	0.01	.00	0.04	4
MRG-1 (r)	39.32	8.50	17.82	--	13.49	14.77	0.71	0.18	3.69	0.17	0.06	
MEAN	39.02	8.54	17.81	--	13.89	14.75	0.71	0.17	3.89	0.18	0.06	3
S.D.	0.25	0.04	0.30	--	0.12	0.04	.00	.00	0.05	ERR	.00	3
QLO-1 (r)	65.93	16.37	4.29	--	1.04	3.24	4.23	3.63	0.62	0.09	0.26	
MEAN	65.86	16.50	4.33	--	1.03	3.19	4.26	3.68	0.60	0.10	0.28	5
S.D.	0.35	0.22	0.05	--	0.01	0.03	0.05	0.04	0.02	.00	0.01	5
RGM-1 (r)	73.47	13.80	1.89	--	0.28	1.18	4.12	4.35	0.27	0.04	0.05	
MEAN	73.01	13.92	1.80	--	0.29	1.18	4.11	4.39	0.27	0.04	0.04	5
S.D.	0.34	0.13	0.06	--	0.01	0.01	0.01	0.05	0.01	0.01	0.01	5

	SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	CaO	Na_2O	K_2O	TiO_2	MnO	P_2O_5	N
SCO-1 (r)	63.39	13.70	5.22	--	2.76	2.64	0.95	2.82	0.62	0.05	0.22	
MEAN	63.08	13.90	5.30	--	2.75	2.59	0.93	2.73	0.60	0.05	0.21	5
S.D.	0.91	0.17	0.04	--	0.03	0.01	0.01	0.07	0.01	.00	0.01	5
SDC-1 (r)	66.15	15.75	6.85	--	1.70	1.39	2.10	3.24	1.00	0.12	0.15	
MEAN	65.90	15.85	6.97	--	1.72	1.42	2.05	3.29	0.99	0.12	0.16	4
S.D.	0.26	0.17	0.02	--	0.02	0.01	.00	0.04	0.02	.00	.00	4
STM-1 (r)	59.66	18.44	5.20	--	0.10	1.09	8.95	4.29	0.13	0.22	0.16	
MEAN	59.08	18.56	5.05	--	0.10	1.12	8.96	4.32	0.14	0.21	0.15	5
S.D.	0.36	0.15	0.06	--	0.01	0.01	0.09	0.06	0.01	0.01	.00	5
SY-2 (r)	60.10	12.12	6.28	--	2.70	7.98	4.34	4.48	0.14	0.32	0.43	
MEAN	60.02	12.20	6.36	--	2.72	8.04	4.29	4.47	0.14	0.32	0.43	3
S.D.	0.72	0.13	0.07	--	0.02	0.04	0.05	0.06	0.01	0.01	0.03	3
UB-N (r)	39.43	2.90	8.34	--	35.21	1.20	0.10	0.02	0.11	0.12	0.04	
MEAN	39.88	2.91	8.33	--	36.70	1.19	0.14	0.01	0.11	0.13	0.01	5
S.D.	0.14	0.03	0.08	--	0.47	0.01	.00	ERR	0.02	.00	ERR	5

(r) Recommended Value For The Control
N -- Number Of Analyses
* Total Fe as Fe2O3

SUMMARY OF CONTROLS FOR TRACE ELEMENTS BY ATOMIC ABSORPTION
(Department Of Mines Laboratory)

CONTROL	BA	CU	ZN	PB	SR	NI	LI	RB	CR	V	BE	MO	CO	N
MRG-1 (r)	50.00	135.00	185.00	10.00	260.00	200.00	4.00	0.00	420.00	520.00	0.60	5.00	86.00	
MEAN	83.50	109.13	193.38	1.00	260.50	145.31	10.44	12.75	327.31	539.94	0.95	4.75	65.83	/8
S.D.	16.05	4.04	7.03	0.00	14.61	5.45	3.90	3.96	21.21	19.45	0.10	1.25	2.34	/8
SY-2 (r)	460.00	5.00	250.00	86.00	275.00	10.00	93.00	220.00	10.00	52.00	23.00	3.00	11.00	
MEAN	460.44	5.19	264.31	76.56	274.50	4.63	90.19	209.94	7.19	61.38	19.20	3.25	5.86	/8
S.D.	31.32	0.63	50.34	2.67	0.00	0.06	7.50	21.30	1.42	10.59	7.06	0.43	2.47	/8

(r) Recommended Value For Control
N -- Number Of Analyses

SUMMARY OF CONTROLS FOR TRACE ELEMENTS BY ICP SPECTROSCOPY
(Department Of Mines Laboratory)

CONTROL	GA	NB	ZR	TH	Y	LA	CE	
AND-1(r)	17.00	9.00	143.00	11.00	24.00	24.00	89.00	
MEAN	16.60	4.60	163.00	2.40	17.60	22.80	42.40	5
S.D.	0.80	0.49	6.90	1.02	0.49	0.75	1.50	5
BS-1 (r)	17.00	8.00	119.00	5.00	28.00	9.00	77.00	
MEAN	19.60	2.40	98.00	1.00	22.00	17.40	26.40	5
S.D.	1.74	0.80	16.12	0.00	1.10	1.20	5.95	5
GA-1 (r)	19.00	8.00	80.00	7.00	19.00	16.00	45.00	
MEAN	18.40	7.40	113.60	4.60	30.60	26.20	49.80	5
S.D.	2.33	10.84	46.76	5.82	25.70	17.41	41.73	5
GD-1 (r)	14.00	12.00	117.00	16.00	16.00	22.00	48.00	
MEAN	10.75	9.50	79.25	11.75	15.75	24.25	42.50	4
S.D.	0.83	0.50	7.98	3.70	0.43	0.43	4.82	4
GD-2 (r)	12.00	10.00	62.00	29.00	14.00	7.00	19.00	
MEAN	4.25	8.25	79.00	18.50	13.75	4.25	9.00	4
S.D.	2.05	0.43	5.39	4.33	0.83	1.09	3.24	4
MRG-1 (r)	18.00	20.00	105.00	1.00	16.00	10.00	25.00	
MEAN	24.50	13.50	121.33	1.06	10.50	17.50	38.67	18
S.D.	1.21	0.83	17.25	0.23	0.83	5.74	3.04	18
RH-1 (r)	17.00	11.00	258.00	7.00	60.00	25.00	92.00	
MEAN	15.20	9.60	260.80	2.60	46.40	22.20	50.00	5
S.D.	0.75	0.80	13.63	1.36	1.02	0.75	4.43	5
SY-2 (r)	28.00	23.00	280.00	380.00	130.00	88.00	210.00	
MEAN	23.89	25.56	313.78	383.44	129.67	69.44	164.83	18
S.D.	1.41	0.96	18.89	26.98	4.56	3.04	5.68	18

(r) Recommended Value For Control
N -- Number Of Analyses

Table 1.2

SUMMARY OF ANALYTICAL PROGRAM AND PRECISION OF ANALYSIS

Variable	Laboratory	Analytical Method	Detection Limit	Mean Value	Range	Number of Analyses*	Number of Duplicates	Mean Precision	Median Precision
Oxide (wt%)									
SiO2	N.D.M	AAS	0.07	67.42	39.25 - 88.45	1489	73	0.57%	0.38%
TiO2	N.D.M	AAS	0.01	0.48	0.01 - 2.77	1489	73	8.37%	4.35%
Al2O3	N.D.M	AAS	0.01	14.53	4.60 - 25.40	1489	73	1.06%	0.87%
Fe2O3	N.D.M	AAS	0.01	1.45	0.00 - 27.39	1489	73	10.39%	6.54%
FeO	N.D.M	Titration	0.01	2.32	0.01 - 14.04	1481	73	9.16%	3.96%
MnO	N.D.M	AAS	0.01	0.08	0.01 - 0.45	1489	73	5.92%	0.00%
MgO	N.D.M	AAS	0.01	1.35	0.01 - 28.02	1489	73	9.69%	2.30%
CaO	N.D.M	AAS	0.01	2.44	0.01 - 16.20	1489	73	4.17%	1.46%
Na2O	N.D.M	AAS	0.01	4.10	0.15 - 10.90	1489	73	1.45%	0.79%
K2O	N.D.M	AAS	0.01	4.52	0.06 - 12.06	1489	73	4.22%	1.01%
P2O5	N.D.M	AAS	0.01	0.13	0.01 - 2.26	1489	73	12.86%	4.65%
LOI	N.D.M	Oven Drying	n/a	0.71	0.02 - 6.02	1485	73	13.70%	7.02%
Element (ppm)									
Li	N.D.M	AAS	5	21.0	1 - 286	1491	73	13.29%	8.22%
Be	N.D.M	AAS	0.1	3.7	0.1 - 29.1	830	37	25.35%	2.98%
F	N.D.M	ISE	30	866.5	11 - 9960	1487	52	15.51%	9.38%
Sc	Becquerel	INAA	0.1	4.5	0.2 - 75.0	529	23	22.14%	9.52%
V	N.D.M	AAS	20	49.7	1 - 705	1494	73	25.52%	15.40%
Cr	N.D.M	AAS	1	34.3	1 - 1840	1491	73	20.39%	5.70%
Co	N.D.M	AAS	1	7.3	1 - 82	830	37	68.74%	0.00%
Ni	N.D.M	AAS	1	10.3	1 - 823	1491	73	18.86%	0.00%
Cu	N.D.M	AAS	1	15.1	1 - 809	1491	73	7.41%	0.00%
Zn	N.D.M	AAS	1	70.0	1 - 527	1491	73	3.69%	2.53%
Ga	N.D.M	ICP-ES	1	15.9	1 - 71	1490	74	5.26%	4.44%
As	Becquerel	INAA	0.5	2.0	0.1 - 54.0	529	23	24.10%	9.52%
Rb	N.D.M	AAS	5	144.5	1 - 1250	1491	73	6.69%	2.84%
Sr	N.D.M	AAS	2	250.8	2 - 1930	1490	73	5.76%	1.90%
Y	N.D.M	ICP-ES	1	40.9	2 - 381	1490	74	3.90%	3.45%
Zr	N.D.M	ICP-ES	1	229.4	11 - 2880	1490	74	6.24%	4.44%
Nb	N.D.M	ICP-ES	1	19.0	1 - 249	1490	74	7.00%	3.64%
Mo	N.D.M	AAS	2	8.3	1 - 4752	1491	73	19.60%	0.00%
Sn	Bondar-Clegg	XRF-ES	1	4.4	1 - 116	529	23	73.29%	66.67%
Sb	Becquerel	INAA	0.1	0.34	0.1 - 7.9	529	23	18.53%	0.00%
Cs	Becquerel	INAA	0.5	2.42	0.5 - 32.0	529	23	24.41%	5.97%
Ba	N.D.M	AAS	30	690.8	6 - 5140	1491	73	9.14%	3.13%
La	N.D.M	ICP-ES	1	59.3	1 - 1312	1490	74	5.26%	4.65%
Ce	N.D.M	ICP-ES	2	119.7	1 - 2226	1490	74	5.46%	4.06%
Sm	Becquerel	INAA	0.1	11.3	0.1 - 113.0	529	23	7.44%	4.26%
Tb	Becquerel	INAA	0.5	1.6	1.0 - 16.0	529	23	22.94%	0.00%
Yb	Becquerel	INAA	0.5	5.6	3.0 - 36.0	529	23	14.85%	4.00%
Lu	Becquerel	INAA	0.5	0.9	0.2 - 6.0	529	23	14.89%	2.38%
Hf	Becquerel	INAA	1.0	11.5	1.0 - 150.0	529	23	24.76%	12.24%
Ta	Becquerel	INAA	0.3	1.6	1.0 - 9.0	529	23	23.30%	5.13%
W	Becquerel	INAA	2	1.5	1.0 - 40.0	529	23	4.00%	0.00%
Pb	N.D.M	AAS	2	20.1	1 - 2900	1491	73	6.19%	5.13%
Th	N.D.M	ICP-ES	1	13.3	1 - 163	1490	74	27.85%	13.33%
U	N.A.S	INAA	0.2	4.5	0.1 - 74.7	1491	52	9.20%	6.45%

Laboratory : N.D.M --- Newfoundland Department of Mines, St. John's.
N.A.S --- Nuclear Activation Services, Hamilton.
Becquerel --- Becquerel Laboratories, Mississauga (subsiduary of Bondar-Clegg)
Bondar-Clegg --- Bondar-Clegg and Co. Ltd , Ottawa.

Methods : AAS --- Atomic Absorption Spectrophotometry
ICP-ES --- Inductively-Coupled Plasma Emission Spectrometry
INAA --- Instrumental Neutron Activation Analysis
ISE --- Ion-Selective Electrode
XRF-ES --- X-Ray Fluorescence Emission Spectrometry

GUIDE TO APPENDICES

Appendices contain numerical data and statistical summaries of data. This is a brief guide to their contents and interpretation.

Table 3A : This contains univariate summary statistics for all of the units described in chapter 2. Statistics include mean, median, standard deviation, minimum, maximum, range and number of valid cases.

Table 3B: This illustrates the contrasting compositions of the Monkey Hill, Strawberry and Lanceground intrusive suites, and also their contrast with the regional granitoid units. This is identical to Table 2 of Kerr (1988a).

Table 3C: This contains chemical analyses of all "regional" samples -- i.e. all samples collected using a predetermined 2 x 2 km grid system . Note that all samples with numbers ending in the digit "9" represent either analytical duplicates or control analyses. Those with analytical data but no field information are duplicates, whereas those with no information at all are numbers reserved for controls. For details of analytical techniques, precision and accuracy, see Chapter 3.

Table 3D: This contains chemical analyses for all "follow-up" samples -- i.e. samples collected within favourable units on a 1 x 1 km spacing. Comments above apply to this table also

Table 3E: This contains chemical analyses for "geological" samples -- i.e. samples collected without any predetermined pattern, and intended to be representative of common rock types or unusual lithologies. Comments above apply to this table also.

Table 3

UNIVARIATE STATISTICS FOR UNIT 3 (UPPER AILLIK GROUP - UNDIVIDED)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	73.30	73.52	3.46	24.40	57.95	82.35	64
TIO2	0.27	0.24	0.14	0.68	0.08	0.76	64
AL2O3	13.00	12.89	1.67	9.66	9.54	19.20	64
FE2O3	1.62	1.54	0.79	3.44	0.39	3.83	64
FEO	0.73	0.60	0.50	2.44	0.01	2.45	64
MNO	0.05	0.05	0.02	0.15	0.01	0.16	64
MGO	0.27	0.17	0.37	2.14	0.01	2.15	64
CAO	0.95	0.67	0.94	4.87	0.01	4.88	64
NA2O	3.87	3.88	1.34	7.13	0.15	7.28	64
K2O	4.91	5.06	2.07	9.49	0.06	9.55	64
P2O5	0.04	0.03	0.04	0.23	0.01	0.24	64
LOI	0.57	0.46	0.38	2.29	0.21	2.50	63
BA	503.44	481.00	415.10	1911.00	9.00	1920.00	64
CU	6.94	4.00	10.13	57.00	1.00	58.00	64
ZN	65.56	51.00	53.71	299.00	7.00	306.00	64
PB	19.41	19.00	10.14	39.00	2.00	41.00	64
SR	108.53	66.00	140.09	909.00	10.00	919.00	64
NI	3.08	1.00	9.17	69.00	1.00	70.00	64
LI	13.34	9.50	12.82	70.00	2.00	72.00	64
RB	149.78	157.50	71.73	366.00	5.00	371.00	64
CR	10.31	4.00	32.39	258.00	1.00	259.00	64
V	9.65	2.00	15.63	97.00	1.00	98.00	52
MO	5.53	2.00	11.48	61.00	1.00	62.00	64
CO	1.46	1.00	1.16	6.00	1.00	7.00	41
AG	0.12	0.10	0.09	0.40	0.10	0.50	23
BE	3.86	3.60	1.50	8.50	1.10	9.60	41
GA	13.09	10.00	6.96	26.00	6.00	32.00	64
NB	22.88	21.00	11.60	61.00	4.00	65.00	64
ZR	341.64	324.00	188.24	1185.00	96.00	1281.00	64
TH	13.92	13.00	8.26	39.00	1.00	40.00	64
Y	50.31	49.50	27.56	127.00	4.00	131.00	64
LA	58.17	60.00	31.22	122.00	0.00	122.00	64
CE	125.45	125.00	59.96	223.00	24.00	247.00	64
U	5.63	4.80	3.02	16.30	1.20	17.50	64
F	427.50	242.00	411.48	1633.00	20.00	1653.00	64
SN	5.42	5.00	4.14	24.00	1.00	25.00	50
SC	2.89	2.55	2.22	12.27	0.20	12.50	50
AS	4.84	2.00	9.42	53.59	0.00	54.00	50
SB	0.82	0.39	1.38	7.80	0.10	7.90	50
CS	1.15	0.57	1.08	4.72	0.00	5.00	50
SM	11.74	12.00	5.50	23.20	1.30	24.50	50
TB	1.93	2.00	0.94	3.50	1.00	4.00	50
YB	6.98	7.30	3.21	12.50	3.00	15.00	50
LU	1.09	1.10	0.53	2.41	0.20	2.60	50
HF	12.86	12.00	5.28	30.00	4.00	34.00	50
TA	1.86	1.85	0.95	4.20	1.00	5.00	50
W	1.65	1.00	3.34	23.48	1.00	24.00	50

UNIVARIATE STATISTICS FOR UNIT 10 (LONG ISLAND QUARTZ MONZONITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	63.32	63.05	1.27	4.85	61.85	66.70	15
TIO2	0.88	0.86	0.06	0.24	0.76	1.00	15
AL2O3	15.81	15.86	0.24	0.82	15.41	16.23	15
FE2O3	1.79	1.92	0.37	1.23	1.11	2.34	15
FEO	3.06	2.82	0.73	2.45	2.32	4.77	15
MNO	0.10	0.10	0.01	0.05	0.08	0.13	15
MGO	1.25	1.32	0.42	1.63	0.17	1.80	15
CAO	2.96	2.92	0.48	1.67	1.97	3.64	15
NA2O	4.28	4.26	0.25	1.12	3.72	4.84	15
K2O	4.75	4.69	0.49	1.84	3.91	5.75	15
P2O5	0.26	0.27	0.03	0.14	0.17	0.31	15
LOI	0.64	0.57	0.23	0.76	0.39	1.15	15
BA	1424.00	1420.00	116.24	480.00	1210.00	1690.00	15
CU	9.13	7.00	3.83	14.00	5.00	19.00	15
ZN	74.07	75.00	8.45	38.00	52.00	90.00	15
PB	15.87	16.00	3.91	17.00	4.00	21.00	15
SR	327.60	324.00	39.01	183.00	264.00	447.00	15
NI	2.60	2.00	1.88	6.00	1.00	7.00	15
LI	22.67	23.00	5.65	24.00	10.00	34.00	15
RB	126.40	121.00	24.21	106.00	92.00	198.00	15
CR	5.53	4.00	3.50	12.00	2.00	14.00	15
V	74.60	77.00	19.61	74.00	32.00	106.00	15
MO	4.33	4.00	0.49	1.00	4.00	5.00	15
AG	0.12	0.10	0.06	0.20	0.10	0.30	15
GA	18.33	19.00	1.23	4.00	16.00	20.00	15
NB	14.20	14.00	1.08	4.00	13.00	17.00	15
ZR	223.93	193.00	66.04	202.00	134.00	336.00	15
TH	9.13	10.00	3.09	12.00	0.00	12.00	15
Y	36.53	37.00	1.92	7.00	34.00	41.00	15
LA	53.33	54.00	4.91	18.00	43.00	61.00	15
CE	102.67	104.00	6.14	22.00	90.00	112.00	15
U	4.82	5.20	0.88	3.10	2.70	5.80	15
F	860.53	848.00	212.67	1010.00	530.00	1540.00	15
SN	1.00	1.00	0.00	0.00	1.00	1.00	5
SC	9.64	10.00	1.65	4.30	7.70	12.00	5
AS	3.00	3.00	0.71	2.00	2.00	4.00	5
SB	0.36	0.40	0.15	0.40	0.10	0.50	5
CS	1.30	0.50	1.15	2.50	1.00	3.00	5
SM	9.16	8.70	0.78	1.60	8.40	10.00	5
TB	0.80	0.50	0.67	1.50	1.00	2.00	5
YB	2.50	2.50	0.00	0.00	3.00	3.00	5
LU	0.50	0.50	0.00	0.00	0.50	0.50	5
HF	8.00	8.00	1.23	3.00	6.00	9.00	5
TA	1.10	0.50	0.82	1.50	1.00	2.00	5
W	1.00	1.00	0.00	0.00	1.00	1.00	5

UNIVARIATE STATISTICS FOR UNIT 12 (MELODY GRANITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	72.27	72.90	3.26	13.30	64.25	77.55	31
TIO2	0.35	0.28	0.21	0.90	0.05	0.95	31
AL2O3	13.50	13.44	1.10	4.84	11.72	16.56	31
FE2O3	0.97	0.68	0.68	2.73	0.27	3.00	31
FEO	1.74	1.50	1.12	5.16	0.36	5.52	31
MNO	0.04	0.03	0.02	0.10	0.01	0.11	31
MGO	0.41	0.25	0.37	1.55	0.05	1.60	31
CAO	1.18	0.90	0.72	2.61	0.54	3.15	31
NA2O	3.80	3.57	0.76	4.19	3.04	7.23	31
K2O	4.59	4.81	0.99	5.52	0.08	5.60	31
P2O5	0.09	0.06	0.07	0.26	0.02	0.28	31
LOI	0.70	0.64	0.34	1.54	0.29	1.83	31
BA	827.58	751.00	481.75	1812.00	38.00	1850.00	31
CU	7.26	3.00	15.06	85.00	2.00	87.00	31
ZN	44.97	43.00	27.92	99.00	7.00	106.00	31
PB	14.10	14.00	7.47	30.00	1.00	31.00	31
SR	106.81	76.00	89.90	419.00	14.00	433.00	31
NI	1.68	1.00	1.49	7.00	1.00	8.00	31
LI	18.13	14.00	13.54	51.00	1.00	52.00	31
RB	121.97	125.00	36.01	196.00	6.00	202.00	31
CR	3.68	2.00	3.46	15.00	1.00	16.00	31
V	24.29	20.00	17.66	70.00	5.00	75.00	31
MO	3.36	3.00	1.02	4.00	2.00	6.00	31
AG	0.10	0.10	0.02	0.10	0.10	0.20	31
GA	18.29	18.00	2.19	11.00	13.00	24.00	31
NB	20.65	21.00	5.58	21.00	8.00	29.00	31
ZR	201.65	203.00	64.12	303.00	28.00	331.00	31
TH	12.10	14.00	6.13	26.00	0.00	26.00	31
Y	45.16	43.00	17.82	79.00	3.00	82.00	31
LA	85.19	76.00	38.16	197.00	0.00	197.00	31
CE	171.39	156.00	66.80	324.00	1.00	325.00	31
U	3.67	3.00	1.96	10.30	1.50	11.80	31
F	613.71	517.00	481.25	1631.00	51.00	1682.00	31
SN	4.37	4.00	3.66	16.00	1.00	17.00	19
SC	2.86	2.60	1.61	6.00	0.80	6.80	19
AS	1.53	0.50	2.51	10.50	1.00	11.00	19
SB	0.18	0.10	0.18	0.70	0.10	0.80	19
CS	2.16	2.00	1.43	4.50	1.00	5.00	19
SM	13.79	14.00	4.99	19.80	0.30	20.10	19
TB	2.21	2.00	0.77	2.50	1.00	3.00	19
YB	5.21	6.00	2.53	6.50	3.00	9.00	19
LU	0.72	0.50	0.33	0.80	0.50	1.30	19
HF	10.84	10.00	4.13	17.00	1.00	18.00	19
TA	1.50	2.00	0.82	2.50	1.00	3.00	19
W	1.00	1.00	0.00	0.00	1.00	1.00	19

UNIVARIATE STATISTICS FOR UNIT 13 (ANNA LAKE AREA)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	68.50	70.12	6.67	20.60	56.45	77.05	8
TIO2	0.51	0.45	0.36	0.97	0.11	1.08	8
AL2O3	14.76	14.38	1.75	5.63	11.76	17.39	8
FE2O3	1.28	0.99	0.91	2.76	0.24	3.00	8
FEO	2.45	1.69	1.80	4.78	0.63	5.41	8
MNO	0.07	0.06	0.04	0.11	0.02	0.13	8
MGO	0.85	0.61	0.78	2.40	0.06	2.46	8
CAO	2.52	2.37	1.78	5.58	0.53	6.11	8
NA2O	3.91	3.91	0.55	1.53	3.33	4.86	8
K2O	3.95	4.07	0.90	2.28	2.73	5.01	8
P2O5	0.19	0.15	0.17	0.54	0.01	0.55	8
LOI	0.87	0.62	0.56	1.39	0.39	1.78	8
BA	939.13	1000.00	357.85	1037.00	293.00	1330.00	8
CU	18.13	6.00	31.29	92.00	3.00	95.00	8
ZN	61.25	52.50	30.84	89.00	16.00	105.00	8
PB	19.00	19.50	7.58	20.00	7.00	27.00	8
SR	277.00	221.50	176.95	528.00	31.00	559.00	8
NI	2.13	1.00	1.89	5.00	1.00	6.00	8
LI	19.63	16.50	12.81	37.00	5.00	42.00	8
RB	98.88	82.00	39.22	107.00	64.00	171.00	8
CR	6.38	5.50	5.18	15.00	1.00	16.00	8
V	48.00	47.00	30.05	85.00	5.00	90.00	8
MO	3.50	4.00	0.76	2.00	2.00	4.00	8
AG	0.10	0.10	0.00	0.00	0.10	0.10	8
GA	17.50	17.00	3.30	10.00	11.00	21.00	8
NB	13.75	13.50	6.50	18.00	6.00	24.00	8
ZR	154.75	168.00	48.60	117.00	96.00	213.00	8
TH	11.88	10.50	7.90	22.00	3.00	25.00	8
Y	29.38	30.50	18.72	54.00	4.00	58.00	8
LA	54.63	62.00	23.59	58.00	19.00	77.00	8
CE	108.00	120.00	43.91	103.00	47.00	150.00	8
U	2.93	2.90	1.05	3.70	0.90	4.60	8
F	688.13	752.50	259.63	870.00	135.00	1005.00	8
SN	9.00	9.00	7.07	10.00	4.00	14.00	2
SC	1.95	1.95	1.34	1.90	1.00	2.90	2
AS	1.25	1.25	1.06	1.50	1.00	2.00	2
SB	0.25	0.25	0.21	0.30	0.10	0.40	2
CS	1.25	1.25	1.06	1.50	1.00	2.00	2
SM	8.05	8.00	5.59	7.90	4.10	12.00	2
TB	1.25	1.25	1.06	1.50	1.00	2.00	2
YB	4.75	4.75	3.18	4.50	3.00	7.00	2
LU	0.50	0.50	0.00	0.00	0.50	0.50	2
HF	6.00	6.00	4.24	6.00	3.00	9.00	2
TA	1.25	1.25	1.06	1.50	1.00	2.00	2
W	1.00	1.00	0.00	0.00	1.00	1.00	2

IVARIATE STATISTICS FOR UNIT 14 (BRUMWATER GRANITE)

RIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
O2	72.73	----	1.26	2.65	70.85	73.50	4
O2	0.16	----	0.09	0.21	0.08	0.29	4
2O3	14.66	----	0.44	0.97	14.34	15.31	4
2O3	0.64	----	0.44	1.01	0.25	1.26	4
O	0.66	----	0.29	0.64	0.44	1.08	4
O	0.03	----	0.01	0.01	0.03	0.04	4
O	0.65	----	0.27	0.66	0.32	0.98	4
O	0.99	----	0.03	0.07	0.96	1.03	4
2O	5.06	----	0.93	2.05	4.32	6.37	4
O	3.34	----	1.46	3.38	1.54	4.92	4
O5	0.06	----	0.02	0.04	0.04	0.08	4
I	0.93	----	0.29	0.69	0.64	1.33	4
	912.50	----	446.57	1080.00	320.00	1400.00	4
	3.50	----	1.29	3.00	2.00	5.00	4
	29.25	----	3.86	9.00	24.00	33.00	4
	12.50	----	7.94	18.00	1.00	19.00	4
	273.50	----	47.47	104.00	221.00	325.00	4
	3.00	----	2.71	6.00	1.00	7.00	4
	11.50	----	1.73	3.00	10.00	13.00	4
	96.50	----	40.98	93.00	60.00	153.00	4
	7.50	----	5.75	12.00	4.00	16.00	4
	2.00	----	0.82	2.00	1.00	3.00	4
	2.00	----	0.00	0.00	2.00	2.00	4
	2.50	----	1.73	4.00	1.00	5.00	4
	2.45	----	0.33	0.80	2.10	2.90	4
	6.75	----	1.71	4.00	5.00	9.00	4
	2.00	----	0.00	0.00	2.00	2.00	4
	59.25	----	11.53	23.00	49.00	72.00	4
	1.75	----	0.96	2.00	1.00	3.00	4
	5.75	----	1.71	4.00	4.00	8.00	4
	13.75	----	4.65	10.00	8.00	18.00	4
	19.00	----	11.58	24.00	5.00	29.00	4
	1.68	----	0.49	1.20	1.10	2.30	4
	187.50	----	68.44	162.00	120.00	282.00	4

UNIVARIATE STATISTICS FOR UNIT 16 (MANAK ISLAND GRANODIORITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	70.13	----	0.69	1.85	69.10	70.95	6
TIO2	0.31	----	0.03	0.08	0.27	0.35	6
AL2O3	15.83	----	0.40	1.00	15.43	16.43	6
FE2O3	1.06	----	0.26	0.70	0.70	1.40	6
FEO	0.90	----	0.19	0.52	0.56	1.08	6
MNO	0.04	----	0.01	0.02	0.03	0.05	6
MGO	0.54	----	0.03	0.09	0.50	0.59	6
CAO	1.78	----	0.21	0.64	1.44	2.08	6
NA2O	4.89	----	0.19	0.46	4.65	5.11	6
K2O	3.93	----	0.14	0.38	3.80	4.18	6
P2O5	0.12	----	0.01	0.02	0.10	0.12	6
LOI	0.42	----	0.16	0.44	0.25	0.69	6
BA	1560.00	----	174.36	480.00	1310.00	1790.00	6
CU	4.50	----	1.23	3.00	2.00	5.00	6
ZN	43.17	----	10.25	28.00	23.00	51.00	6
PB	11.33	----	2.81	8.00	6.00	14.00	6
SR	596.33	----	75.30	207.00	480.00	687.00	6
NI	1.50	----	0.55	1.00	1.00	2.00	6
LI	22.50	----	6.06	17.00	16.00	33.00	6
RB	79.33	----	24.92	65.00	59.00	124.00	6
CR	2.50	----	0.84	2.00	2.00	4.00	6
V	29.00	----	4.94	11.00	23.00	34.00	6
MO	2.00	----	0.89	2.00	1.00	3.00	6
AG	0.10	----	0.00	0.00	0.10	0.10	6
GA	13.17	----	2.93	8.00	11.00	19.00	6
NB	5.00	----	1.27	3.00	3.00	6.00	6
ZR	99.00	----	20.96	60.00	76.00	136.00	6
TH	4.83	----	2.93	7.00	2.00	9.00	6
Y	8.50	----	1.23	3.00	8.00	11.00	6
LA	26.00	----	5.33	14.00	22.00	36.00	6
CE	46.00	----	8.70	24.00	36.00	60.00	6
U	1.78	----	0.45	1.10	1.20	2.30	6
F	411.33	----	133.94	361.00	194.00	555.00	6

UNIVARIATE STATISTICS FOR UNIT 20 (ADLAVIK INTRUSIVE SUITE GABBRO)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	50.10	49.52	3.88	24.55	42.85	67.40	74
TIO2	0.94	0.87	0.42	2.40	0.37	2.77	74
AL2O3	15.33	15.54	3.27	15.80	5.88	21.68	74
FE2O3	2.90	2.69	0.95	4.39	1.36	5.75	74
FEO	6.37	6.52	1.29	8.87	1.38	10.25	74
MNO	0.17	0.17	0.03	0.20	0.04	0.24	74
MGO	7.72	6.63	4.22	19.28	0.75	20.03	74
CAO	9.69	9.01	2.98	14.07	2.14	16.21	74
NA2O	2.98	3.24	1.11	4.42	0.91	5.33	74
K2O	1.62	1.43	0.95	5.48	0.21	5.69	74
P2O5	0.30	0.21	0.30	1.59	0.03	1.62	74
LOI	1.36	1.37	0.56	2.43	0.27	2.70	74
BA	622.19	548.50	463.05	3158.00	152.00	3310.00	74
CU	53.68	43.00	41.14	214.00	4.00	218.00	74
ZN	95.81	93.00	33.55	195.00	40.00	235.00	74
PB	5.15	2.00	7.39	40.00	1.00	41.00	74
SR	672.99	646.00	283.66	1784.00	146.00	1930.00	74
NI	67.91	45.50	87.50	465.00	1.00	466.00	74
LI	22.47	21.00	9.40	47.00	6.00	53.00	74
RB	46.55	41.00	28.88	144.00	8.00	152.00	74
CR	277.32	141.00	379.06	1839.00	1.00	1840.00	74
V	145.42	173.00	100.38	490.00	3.00	493.00	74
MO	4.00	3.00	4.35	37.00	2.00	39.00	74
CO	34.23	33.00	15.98	62.00	4.00	66.00	22
AG	0.14	0.10	0.08	0.30	0.10	0.40	52
BE	2.09	1.80	1.14	4.00	0.90	4.90	21
GA	18.37	19.00	4.72	25.00	6.00	31.00	74
NB	3.15	2.00	3.94	19.00	0.00	19.00	74
ZR	90.61	82.00	45.04	273.00	28.00	301.00	74
TH	1.30	0.00	2.51	18.00	0.00	18.00	74
Y	20.58	19.00	10.26	64.00	5.00	69.00	74
LA	25.93	23.50	15.83	91.00	6.00	97.00	74
CE	50.38	46.00	31.97	190.00	11.00	201.00	74
U	1.07	0.75	0.93	4.10	0.10	4.20	74
F	672.42	644.50	484.18	2950.00	54.00	3004.00	74
SN	1.00	1.00	0.00	0.00	1.00	1.00	16
SC	32.38	28.80	15.69	63.00	12.00	75.00	16
AS	1.50	0.50	2.36	9.50	1.00	10.00	16
SB	0.23	0.10	0.27	1.00	0.10	1.10	16
CS	1.03	0.50	1.64	6.50	1.00	7.00	16
SM	5.60	5.30	2.19	8.50	1.50	10.00	16
TB	0.50	0.50	0.00	0.00	1.00	1.00	16
YB	2.50	2.50	0.00	0.00	3.00	3.00	16
LU	0.47	0.50	0.09	0.28	0.20	0.50	16
HF	2.24	1.00	1.96	7.00	1.00	8.00	16
TA	0.50	0.50	0.00	0.00	1.00	1.00	16
W	1.02	1.00	0.08	0.30	1.00	1.00	16

UNIVARIATE STATISTICS FOR UNIT 22 (ADLAVIK INTRUSIVE SUITE DIORITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	56.65	56.4	2.309	8.55	53.05	61.6	15
TIO2	0.903	0.84	0.272	1.03	0.67	1.7	15
AL2O3	17.943	17.74	1.243	4.69	15.5	20.19	15
FE2O3	2.147	2.01	0.611	2.17	1.1	3.27	15
FEO	4.709	4.9	1.14	4.19	2.68	6.87	15
MNO	0.129	0.13	0.033	0.13	0.08	0.21	15
MGO	2.789	2.76	1.175	4.09	0.81	4.9	15
CAO	5.562	5.42	1.387	5.03	2.49	7.52	15
NA2O	4.512	4.41	0.745	2.89	3.42	6.31	15
K2O	3.117	3.23	0.723	2.21	2.01	4.22	15
P2O5	0.36	0.34	0.138	0.49	0.17	0.66	15
LOI	0.913	0.78	0.598	2.31	0.18	2.49	15
BA	1207.667	823	930.54	3427	643	4070	15
CU	28.067	25	15.759	56	5	61	15
ZN	80.267	80	13.818	43	56	99	15
PB	9.467	10	4.779	15	1	16	15
SR	695.6	724	141.791	475	443	918	15
NI	11.467	11	8.951	35	1	36	15
LI	21.733	21	6.041	28	11	39	15
RB	81.4	81	26.207	96	39	135	15
CR	26.067	19	26.127	99	1	100	15
V	112	130	57.189	171	20	191	15
MO	3.2	3	1.146	5	1	6	15
AG	0.107	0.1	0.026	0.1	0.1	0.2	15
GA	19.6	19	2.293	9	15	24	15
NB	9.2	9	4.632	15	3	18	15
ZR	136.8	120	79.774	304	68	372	15
TH	5.933	4	6.147	18	0	18	15
Y	23.733	22	6.227	22	15	37	15
LA	38.133	36	9.303	33	23	56	15
CE	73.067	72	19.418	77	40	117	15
U	2.427	1.9	1.36	4.5	0.9	5.4	15
F	840	721	342.513	1305	348	1653	15
SN	1.2	1	0.447	1	1	2	5
SC	15.16	15	5.275	13.8	10	23.8	5
AS	1.5	5	1.541	3.5	1	4	5
SB	0.44	1	0.564	1.3	0.1	1.4	5
CS	1.4	2	0.822	1.5	1	2	5
SM	6.5	6.8	0.752	1.9	5.4	7.3	5
TB	0.5	0.5	0	0	1	1	5
YB	2.5	2.5	0	0	3	3	5
LU	0.5	0.5	0	0	0.5	0.5	5
HF	3.2	3	0.447	1	3	4	5
TA	0.8	0.5	0.671	1.5	1	2	5
W	1	1	0	0	1	1	5

UNIVARIATE STATISTICS FOR UNIT 22 (PLAGIOCLASE-PORPHYRITIC MONZONITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	57.24	57.10	2.52	9.10	52.80	61.90	11
TIO2	0.97	0.92	0.29	1.20	0.41	1.61	11
AL2O3	17.69	17.67	0.94	3.55	15.91	19.46	11
FE2O3	2.25	2.12	0.62	2.19	1.58	3.77	11
FEO	4.60	4.65	1.09	4.05	2.03	6.08	11
MNO	0.12	0.12	0.04	0.15	0.06	0.21	11
MGO	2.41	2.31	0.62	2.12	1.25	3.37	11
CAO	5.14	5.27	1.11	4.24	2.43	6.67	11
NA2O	4.43	4.24	0.70	2.55	3.87	6.42	11
K2O	3.82	3.92	0.82	3.05	1.96	5.01	11
P2O5	0.37	0.32	0.17	0.68	0.15	0.83	11
LOI	0.78	0.76	0.40	1.19	0.23	1.42	11
BA	937.55	817.00	301.05	1070.00	640.00	1710.00	11
CU	33.00	33.00	10.16	32.00	16.00	48.00	11
ZN	87.27	82.00	29.16	121.00	45.00	166.00	11
PB	13.00	13.00	3.58	11.00	7.00	18.00	11
SR	521.27	515.00	102.49	376.00	307.00	683.00	11
NI	11.09	11.00	4.53	17.00	4.00	21.00	11
LI	18.82	20.00	4.77	16.00	11.00	27.00	11
RB	102.91	105.00	36.78	119.00	37.00	156.00	11
CR	21.00	21.00	9.33	29.00	4.00	33.00	11
V	108.55	107.00	32.59	110.00	48.00	158.00	11
MO	4.09	4.00	0.94	3.00	2.00	5.00	11
AG	0.12	0.10	0.06	0.20	0.10	0.30	11
GA	20.27	20.00	2.87	12.00	14.00	26.00	11
NB	15.18	17.00	3.82	11.00	8.00	19.00	11
ZR	171.27	140.00	102.67	303.00	47.00	350.00	11
TH	6.64	7.00	4.82	13.00	0.00	13.00	11
Y	35.82	35.00	7.37	29.00	25.00	54.00	11
LA	54.91	57.00	7.19	24.00	42.00	66.00	11
CE	106.64	112.00	18.47	58.00	70.00	128.00	11
U	3.45	4.00	1.58	4.90	0.40	5.30	11
F	707.27	836.00	353.20	1177.00	164.00	1341.00	11
SN	2.33	2.00	1.53	3.00	1.00	4.00	3
SC	10.80	12.00	3.94	7.60	6.40	14.00	3
AS	2.50	3.00	1.80	3.50	1.00	4.00	3
SB	0.20	0.10	0.17	0.30	0.10	0.40	3
CS	1.50	2.00	0.87	1.50	1.00	2.00	3
SM	8.83	9.20	0.72	1.30	8.00	9.30	3
TB	0.50	0.50	0.00	0.00	1.00	1.00	3
YB	2.50	2.50	0.00	0.00	3.00	3.00	3
LU	0.50	0.50	0.00	0.00	0.50	0.50	3
HF	7.67	7.00	1.16	2.00	7.00	9.00	3
TA	2.00	2.00	0.00	0.00	2.00	2.00	3
W	1.00	1.00	0.00	0.00	1.00	1.00	3

UNIVARIATE STATISTICS FOR UNIT 23 (ADLAVIK ISLANDS QUARTZ MONZONITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	63.31	62.92	4.24	19.85	51.25	71.10	50
TIO2	0.78	0.72	0.31	1.59	0.26	1.85	50
AL2O3	16.30	16.16	1.64	8.79	14.16	22.95	50
FE2O3	1.58	1.48	0.64	2.53	0.54	3.07	50
FEO	3.39	3.53	1.10	4.97	1.15	6.12	50
MNO	0.12	0.11	0.05	0.21	0.05	0.26	50
MGO	0.92	0.76	0.61	2.21	0.19	2.40	50
CAO	2.50	2.26	1.15	5.95	0.92	6.87	50
NA2O	4.68	4.59	0.44	1.88	3.95	5.83	50
K2O	5.31	5.36	0.79	4.49	2.92	7.41	50
P2O5	0.23	0.20	0.15	0.72	0.08	0.80	50
LOI	0.54	0.49	0.31	2.25	0.02	2.27	50
BA	1166.08	937.00	714.81	3674.00	136.00	3810.00	50
CU	10.76	8.00	10.69	62.00	1.00	63.00	50
ZN	89.86	85.50	24.57	93.00	53.00	146.00	50
PB	15.80	15.00	4.99	24.00	2.00	26.00	50
SR	263.26	229.50	165.65	884.00	48.00	932.00	50
NI	2.02	1.00	2.17	12.00	1.00	13.00	50
LI	20.34	21.50	8.74	36.00	3.00	39.00	50
RB	114.18	102.00	47.42	194.00	48.00	242.00	50
CR	4.04	2.00	4.50	21.00	1.00	22.00	50
V	39.52	28.00	27.09	104.00	2.00	106.00	50
MO	3.98	4.00	1.04	5.00	2.00	7.00	50
CO	9.50	9.50	12.02	17.00	1.00	18.00	2
AG	0.13	0.10	0.06	0.20	0.10	0.30	48
BE	4.05	4.05	2.05	2.90	2.60	5.50	2
GA	20.82	21.00	2.82	15.00	10.00	25.00	50
NB	19.52	20.00	7.62	37.00	3.00	40.00	50
ZR	229.00	230.50	127.38	578.00	33.00	611.00	50
TH	7.40	5.50	9.76	56.00	0.00	56.00	50
Y	40.86	42.00	12.92	46.00	16.00	62.00	50
LA	67.68	64.50	36.26	266.00	13.00	279.00	50
CE	133.66	126.50	66.44	456.00	29.00	485.00	50
U	3.26	2.75	1.88	7.80	0.50	8.30	50
F	835.54	835.50	395.80	1654.00	141.00	1795.00	50
SN	2.39	1.00	2.40	8.00	1.00	9.00	13
SC	10.62	10.00	3.02	10.40	5.60	16.00	13
AS	2.92	3.00	2.80	10.50	1.00	11.00	13
SB	0.39	0.10	0.50	1.60	0.10	1.70	13
CS	1.81	0.50	1.99	5.50	1.00	6.00	13
SM	11.92	13.00	4.37	13.60	4.40	18.00	13
TB	1.50	2.00	0.87	2.50	1.00	3.00	13
YB	3.65	2.50	1.82	4.50	3.00	7.00	13
LU	0.56	0.50	0.22	0.80	0.50	1.30	13
HF	9.69	9.00	5.35	20.00	3.00	23.00	13
TA	1.19	0.50	0.78	1.50	1.00	2.00	13
W	1.00	1.00	0.00	0.00	1.00	1.00	13

UNIVARIATE STATISTICS FOR UNIT 24 (SYENITE AND QUARTZ SYENITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	65.96	65.35	4.02	18.20	55.40	73.60	33
TIO2	0.61	0.54	0.29	1.54	0.20	1.74	33
AL2O3	14.98	14.96	1.19	4.93	12.63	17.56	33
FE2O3	1.41	1.37	0.58	2.76	0.18	2.94	33
FEO	3.50	3.31	1.73	8.33	0.34	8.67	33
MNO	0.14	0.16	0.07	0.29	0.04	0.33	33
MGO	0.38	0.33	0.29	1.47	0.04	1.51	33
CAO	1.72	1.77	0.70	3.37	0.27	3.64	33
NA2O	4.53	4.53	0.47	2.05	3.37	5.42	33
K2O	5.72	5.57	0.57	2.48	4.76	7.24	33
P2O5	0.14	0.11	0.13	0.71	0.01	0.72	33
LOI	0.45	0.43	0.22	0.93	0.13	1.06	33
BA	814.15	697.00	514.41	2205.00	105.00	2310.00	33
CU	6.27	6.00	3.17	15.00	1.00	16.00	33
ZN	116.18	109.00	44.91	198.00	20.00	218.00	33
PB	15.55	15.00	6.45	29.00	4.00	33.00	33
SR	108.24	95.00	77.41	386.00	18.00	404.00	33
NI	1.15	1.00	0.87	5.00	1.00	6.00	33
LI	13.03	11.00	7.42	40.00	1.00	41.00	33
RB	114.88	106.00	53.56	247.00	40.00	287.00	33
CR	3.55	2.00	3.27	12.00	1.00	13.00	33
V	13.62	13.00	11.95	49.00	1.00	50.00	29
MO	4.06	4.00	2.02	10.00	2.00	12.00	33
CO	1.39	1.00	0.65	2.00	1.00	3.00	13
AG	0.11	0.10	0.02	0.10	0.10	0.20	20
BE	2.89	2.50	0.96	3.70	1.90	5.60	13
GA	22.82	24.00	8.49	42.00	9.00	51.00	33
NB	23.55	23.00	9.56	45.00	4.00	49.00	33
ZR	245.55	221.00	116.39	472.00	37.00	509.00	33
TH	6.24	4.00	6.71	22.00	0.00	22.00	33
Y	60.61	58.00	28.78	140.00	14.00	154.00	33
LA	92.27	85.00	45.88	232.00	23.00	255.00	33
CE	186.46	168.00	90.51	440.00	33.00	473.00	33
U	2.68	2.40	1.56	5.50	0.60	6.10	33
F	542.09	326.00	547.13	2393.00	56.00	2449.00	33
SN	1.50	1.00	0.93	2.00	1.00	3.00	8
SC	9.56	7.00	7.74	20.50	0.60	21.10	8
AS	0.69	0.50	0.53	1.50	1.00	2.00	8
SB	0.33	0.10	0.48	1.40	0.10	1.50	8
CS	0.88	0.50	0.69	1.50	1.00	2.00	8
SM	17.65	13.00	8.54	21.50	10.00	31.50	8
TB	2.13	2.00	1.22	3.50	1.00	4.00	8
YB	5.50	4.75	3.40	8.50	3.00	11.00	8
LU	0.71	0.50	0.42	1.10	0.50	1.60	8
HF	14.75	15.50	6.18	16.00	6.00	22.00	8
TA	0.69	0.50	0.53	1.50	1.00	2.00	8
W	1.00	1.00	0.00	0.00	1.00	1.00	8

UNIVARIATE STATISTICS FOR UNIT 25.1 (MT.BENEDICT -- PLAG CUMULATE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	56.229	55.57	2.961	11.35	52.2	63.55	12
TIO2	0.966	1.02	0.195	0.54	0.63	1.17	12
AL2O3	17.997	17.3	1.782	5.91	15.67	21.58	12
FE2O3	1.95	1.8	0.397	1.3	1.41	2.71	12
FEO	4.281	4.7	1.035	3.39	1.95	5.34	12
MNO	0.125	0.12	0.032	0.12	0.08	0.2	12
MGO	2.784	2.23	2.138	8.37	0.71	9.08	12
CAO	5.089	4.87	1.411	5.15	1.93	7.08	12
NA2O	4.42	4.47	0.441	1.39	3.52	4.91	12
K2O	3.775	3.65	0.987	3.71	2.46	6.17	12
P2O5	0.38	0.41	0.15	0.57	0.11	0.68	12
LOI	1.354	1.34	0.658	2.47	0.45	2.92	12
BA	1172.083	1044.5	465.351	1733	707	2440	12
CU	49.917	50	26.414	83	16	99	12
ZN	95.917	85.5	28.321	102	75	177	12
PB	12.917	11.5	4.963	20	6	26	12
SR	737.417	743	241.311	784	306	1090	12
NI	22.667	5	51.542	183	1	184	12
LI	28.5	26.5	10.14	36	19	55	12
RB	132.167	113	53.582	189	77	266	12
CR	50.583	17	96.233	333	5	338	12
V	18.833	10	34.496	126	2	128	12
MO	4.833	3.5	4.218	15	3	18	12
CO	14.455	12	9.385	38	2	40	11
BE	3.427	3.4	1.099	4	1.9	5.9	11
GA	18.25	18.5	4.288	18	6	24	12
NB	11.25	10	5.675	18	6	24	12
ZR	141.917	98	95.268	313	36	349	12
TH	8.583	7.5	6.156	19	2	21	12
Y	23.917	25	7.775	28	12	40	12
LA	44.833	42	12.112	41	31	72	12
CE	89.583	84.5	26.541	91	59	150	12
U	3.408	3.15	2.007	6.7	1.2	7.9	12
F	964.333	803.5	395.993	1199	511	1710	12

UNIVARIATE STATISTICS FOR UNIT 25.2 (MT.BENEDICT -- MONZONITE-SYENITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	63.98	65.35	4.66	18.40	51.40	69.80	37
TIO2	0.63	0.57	0.25	1.28	0.34	1.62	37
AL2O3	16.10	15.91	0.86	3.06	14.80	17.86	37
FE2O3	1.41	1.23	0.71	3.33	0.59	3.92	37
FEO	2.66	2.26	1.20	5.78	1.09	6.87	37
MNO	0.09	0.08	0.03	0.11	0.05	0.16	37
MGO	1.23	0.90	1.10	4.82	0.41	5.23	37
CAO	2.54	2.04	1.69	6.74	1.09	7.83	37
NA2O	4.54	4.54	0.38	1.90	3.53	5.43	37
K2O	5.32	5.60	1.03	3.99	2.52	6.51	37
P2O5	0.20	0.16	0.20	1.14	0.03	1.17	37
LOI	0.84	0.78	0.28	1.24	0.53	1.77	37
BA	770.14	696.00	372.34	1875.00	295.00	2170.00	37
CU	17.43	14.00	16.07	78.00	2.00	80.00	37
ZN	61.92	57.00	20.06	94.00	38.00	132.00	37
PB	16.97	17.00	6.63	30.00	1.00	31.00	37
SR	327.81	277.00	204.89	960.00	90.00	1050.00	37
NI	4.30	2.00	5.69	26.00	1.00	27.00	37
LI	31.76	31.00	11.33	53.00	9.00	62.00	37
RB	224.38	237.00	87.93	300.00	79.00	379.00	37
CR	15.19	8.00	18.02	86.00	1.00	87.00	37
V	5.11	4.00	4.67	20.00	1.00	21.00	36
MO	4.92	5.00	1.69	6.00	2.00	8.00	37
CO	6.38	5.00	5.37	27.00	1.00	28.00	37
BE	5.33	4.90	1.87	7.30	1.90	9.20	37
GA	11.22	9.00	5.44	17.00	7.00	24.00	37
NB	19.87	19.00	8.41	40.00	1.00	41.00	37
ZR	283.19	250.00	139.50	465.00	79.00	544.00	37
TH	21.03	20.00	14.65	70.00	3.00	73.00	37
Y	29.76	29.00	9.24	51.00	16.00	67.00	37
LA	49.84	51.00	13.80	59.00	18.00	77.00	37
CE	104.89	100.00	30.08	120.00	36.00	156.00	37
U	6.59	5.30	3.38	13.80	1.10	14.90	37
F	1321.19	1199.00	457.61	1879.00	403.00	2282.00	37
SN	6.14	5.50	4.24	18.00	1.00	19.00	22
SC	5.84	5.05	2.08	7.40	3.60	11.00	22
AS	2.52	1.35	2.98	13.68	0.00	14.00	22
SB	0.50	0.30	0.56	2.58	0.10	2.70	22
CS	10.74	10.00	5.27	25.80	6.00	32.00	22
SM	8.24	7.85	1.65	7.40	4.80	12.20	22
TB	0.84	0.50	0.43	1.30	1.00	2.00	22
YB	4.14	3.95	0.96	4.20	3.00	7.00	22
LU	0.86	0.76	0.36	1.17	0.40	1.60	22
HF	12.16	12.50	2.95	12.60	6.00	19.00	22
TA	1.60	1.60	0.48	1.80	1.00	2.00	22
W	2.67	1.40	2.96	11.46	1.00	12.00	22

UNIVARIATE STATISTICS FOR UNIT 25.3 (MT.BENEDICT -- SYENITE-GRANITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	71.00	71.85	3.11	13.50	62.95	76.45	41
TIO2	0.29	0.22	0.15	0.59	0.09	0.68	41
AL2O3	14.31	13.97	1.10	5.25	12.53	17.78	41
FE2O3	0.96	0.96	0.35	2.12	0.39	2.51	41
FEO	1.07	0.95	0.64	2.77	0.26	3.03	41
MNO	0.05	0.05	0.02	0.08	0.02	0.10	41
MGO	0.36	0.26	0.23	1.16	0.10	1.26	41
CAO	0.97	0.77	0.43	1.89	0.42	2.31	41
NA2O	4.23	4.23	0.45	2.09	3.48	5.57	41
K2O	5.58	5.55	0.55	3.43	3.69	7.12	41
P2O5	0.04	0.03	0.04	0.15	0.01	0.16	41
LOI	0.74	0.75	0.11	0.50	0.52	1.02	41
BA	349.15	284.00	238.42	1212.00	48.00	1260.00	41
CU	10.27	8.00	10.24	57.00	2.00	59.00	41
ZN	37.22	36.00	11.44	66.00	18.00	84.00	41
PB	21.24	21.00	4.65	23.00	9.00	32.00	41
SR	125.66	93.00	87.24	393.00	35.00	428.00	41
NI	1.63	1.00	1.91	9.00	1.00	10.00	41
LI	26.34	23.00	12.24	47.00	12.00	59.00	41
RB	308.78	319.00	83.41	382.00	118.00	500.00	41
CR	5.68	5.00	4.34	25.00	2.00	27.00	41
V	2.34	2.00	1.00	4.00	1.00	5.00	35
MO	3.88	4.00	1.29	5.00	2.00	7.00	41
CO	2.32	2.00	1.42	5.00	1.00	6.00	41
BE	6.79	6.90	1.76	8.90	2.20	11.10	41
GA	7.90	8.00	2.36	16.00	5.00	21.00	41
NB	26.17	26.00	8.11	31.00	7.00	38.00	41
ZR	295.24	302.00	92.38	457.00	109.00	566.00	41
TH	36.83	39.00	15.12	72.00	5.00	77.00	41
Y	27.63	29.00	8.42	32.00	10.00	42.00	41
LA	53.59	54.00	23.81	140.00	17.00	157.00	41
CE	107.88	108.00	43.73	249.00	26.00	275.00	41
U	10.62	10.30	4.95	24.80	0.90	25.70	41
F	1202.68	1312.00	661.11	3112.00	59.00	3171.00	41
SN	7.21	7.00	4.22	16.00	1.00	17.00	38
SC	2.89	2.20	1.68	7.30	1.00	8.30	39
AS	4.11	4.00	2.54	9.50	1.00	10.00	39
SB	0.81	0.70	0.50	2.00	0.10	2.10	39
CS	9.02	7.60	4.25	15.90	2.00	18.00	39
SM	6.91	7.00	1.68	8.80	1.70	10.50	39
TB	0.76	0.50	0.34	0.80	1.00	1.00	39
YB	4.50	4.60	0.94	4.20	3.00	7.00	39
LU	1.07	1.10	0.43	1.72	0.40	2.10	39
HF	9.88	10.00	3.06	14.20	4.00	18.00	39
TA	2.12	2.30	0.64	2.90	1.00	3.00	39
W	3.58	2.40	4.93	30.41	1.00	31.00	39

UNIVARIATE STATISTICS FOR UNIT 25.4 (MT.BENEDICT -- QUARTZ SYENITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	66.94	----	4.70	13.65	59.10	72.75	9
TIO2	0.49	----	0.19	0.62	0.21	0.83	9
AL2O3	15.32	----	1.65	4.46	14.02	18.48	9
FE2O3	1.46	----	0.61	1.67	0.79	2.46	9
FEO	1.50	----	0.76	2.48	0.56	3.04	9
MNO	0.06	----	0.02	0.06	0.03	0.09	9
MGO	0.68	----	0.34	1.14	0.19	1.33	9
CAO	1.91	----	1.05	3.34	0.88	4.22	9
NA2O	4.23	----	0.41	1.27	3.90	5.17	9
K2O	5.52	----	0.80	2.81	4.66	7.47	9
P2O5	0.13	----	0.06	0.20	0.05	0.25	9
LOI	1.05	----	0.62	1.93	0.76	2.69	9
BA	841.89	----	156.36	386.00	654.00	1040.00	9
CU	16.11	----	11.73	27.00	5.00	32.00	9
ZN	65.56	----	34.65	92.00	27.00	119.00	9
PB	26.11	----	10.11	29.00	14.00	43.00	9
SR	236.78	----	144.24	506.00	70.00	576.00	9
NI	2.67	----	2.40	7.00	1.00	8.00	9
LI	15.78	----	3.77	12.00	10.00	22.00	9
RB	166.89	----	53.27	174.00	131.00	305.00	9
CR	7.78	----	3.60	9.00	4.00	13.00	9
V	2.78	----	1.20	3.00	1.00	4.00	9
MO	5.67	----	6.56	20.00	3.00	23.00	9
CO	4.33	----	2.35	8.00	1.00	9.00	9
BE	4.19	----	1.05	3.50	3.30	6.80	9
GA	9.89	----	3.82	12.00	8.00	20.00	9
NB	17.33	----	4.87	17.00	12.00	29.00	9
ZR	212.44	----	54.33	195.00	156.00	351.00	9
TH	11.89	----	6.05	19.00	5.00	24.00	9
Y	33.22	----	8.20	22.00	22.00	44.00	9
LA	43.78	----	10.79	28.00	34.00	62.00	9
CE	87.67	----	20.73	53.00	62.00	115.00	9
U	4.17	----	0.88	2.70	2.70	5.40	9
F	658.33	----	352.25	1043.00	184.00	1227.00	9

UNIVARIATE STATISTICS FOR UNIT 30 (FRESHSTEAK GRANODIORITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	62.82	62.90	4.73	17.45	54.15	71.60	23
TIO2	0.89	0.88	0.34	1.25	0.34	1.59	23
AL2O3	15.96	16.12	1.29	5.87	13.18	19.05	23
FE2O3	2.18	2.09	0.63	2.18	1.46	3.64	23
FEO	3.46	3.31	1.38	5.42	0.91	6.33	23
MNO	0.11	0.11	0.03	0.14	0.05	0.19	23
MGO	1.57	1.50	0.88	3.35	0.14	3.49	23
CAO	3.47	3.30	1.42	5.45	0.57	6.02	23
NA2O	4.30	4.21	0.35	1.70	3.75	5.45	23
K2O	4.13	4.30	0.98	4.08	2.06	6.14	23
P2O5	0.29	0.28	0.13	0.56	0.03	0.59	23
LOI	0.58	0.48	0.31	1.14	0.21	1.35	23
BA	1455.00	1620.00	422.62	1512.00	438.00	1950.00	23
CU	17.13	11.00	26.27	132.00	2.00	134.00	23
ZN	91.65	86.00	25.40	95.00	44.00	139.00	23
PB	14.39	16.00	4.20	14.00	8.00	22.00	23
SR	401.48	411.00	147.83	531.00	66.00	597.00	23
NI	3.87	3.00	4.54	20.00	1.00	21.00	23
LI	26.83	26.00	17.31	91.00	7.00	98.00	23
RB	110.17	121.00	35.73	112.00	52.00	164.00	23
CR	8.83	6.00	7.66	26.00	2.00	28.00	23
V	73.57	68.00	52.26	170.00	5.00	175.00	23
MO	4.04	4.00	0.98	4.00	2.00	6.00	23
CO	9.50	9.50	0.71	1.00	9.00	10.00	2
AG	0.11	0.10	0.03	0.10	0.10	0.20	21
BE	3.35	3.35	1.20	1.70	2.50	4.20	2
GA	20.26	19.00	3.53	15.00	13.00	28.00	23
NB	13.87	13.00	6.86	25.00	6.00	31.00	23
ZR	141.70	104.00	110.75	423.00	45.00	468.00	23
TH	3.96	3.00	4.71	16.00	0.00	16.00	23
Y	39.78	36.00	15.41	64.00	17.00	81.00	23
LA	56.91	51.00	22.16	92.00	23.00	115.00	23
CE	105.91	95.00	44.01	177.00	43.00	220.00	23
U	3.16	3.00	1.49	7.40	1.40	8.80	23
F	747.57	811.00	194.23	920.00	215.00	1135.00	23
SN	1.83	1.00	1.33	3.00	1.00	4.00	6
SC	8.48	8.25	4.36	10.10	3.90	14.00	6
AS	3.00	2.50	2.59	6.50	1.00	7.00	6
SB	0.35	0.30	0.28	0.60	0.10	0.70	6
CS	2.42	2.00	1.50	4.50	1.00	5.00	6
SM	10.98	10.50	5.66	13.70	4.30	18.00	6
TB	1.58	1.25	1.24	2.50	1.00	3.00	6
YB	4.00	2.50	2.41	5.50	3.00	8.00	6
LU	0.60	0.50	0.25	0.60	0.50	1.10	6
HF	9.17	9.00	4.49	11.00	4.00	15.00	6
TA	1.00	0.50	0.78	1.50	1.00	2.00	6
W	1.00	1.00	0.00	0.00	1.00	1.00	6

UNIVARIATE STATISTICS FOR UNIT 31.1 (BIG RIVER GRANITE -- MAIN PHASE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	69.88	69.70	3.99	16.15	61.20	77.35	43
TIO2	0.43	0.40	0.21	0.87	0.10	0.97	43
AL2O3	14.40	14.55	1.59	7.80	11.33	19.13	43
FE2O3	1.17	1.17	0.52	2.79	0.23	3.02	43
FEO	1.61	1.48	0.74	2.94	0.25	3.19	43
MNO	0.06	0.06	0.03	0.10	0.01	0.11	43
MGO	0.44	0.43	0.27	1.13	0.02	1.15	43
CAO	1.34	1.38	0.68	3.73	0.07	3.80	43
NA2O	4.09	4.08	0.63	3.53	3.25	6.78	43
K2O	5.45	5.40	0.59	3.16	4.55	7.71	43
P2O5	0.11	0.09	0.07	0.29	0.02	0.31	43
LOI	0.59	0.60	0.17	0.62	0.30	0.92	43
BA	681.16	658.00	357.47	1865.00	105.00	1970.00	43
CU	6.51	5.00	5.51	22.00	1.00	23.00	43
ZN	55.42	53.00	28.09	135.00	8.00	143.00	43
PB	21.63	20.00	12.25	79.00	5.00	84.00	43
SR	141.09	129.00	92.77	462.00	9.00	471.00	43
NI	1.16	1.00	0.57	3.00	1.00	4.00	43
LI	16.00	14.00	5.95	21.00	8.00	29.00	43
RB	138.33	132.00	45.39	290.00	69.00	359.00	43
CR	2.70	2.00	1.87	8.00	1.00	9.00	43
V	20.50	19.00	12.88	61.00	1.00	62.00	42
MO	3.86	4.00	1.23	5.00	2.00	7.00	43
CO	2.25	2.50	0.96	2.00	1.00	3.00	4
AG	0.10	0.10	0.02	0.10	0.10	0.20	39
BE	3.88	3.80	0.41	0.90	3.50	4.40	4
GA	17.35	18.00	3.84	17.00	8.00	25.00	43
NB	20.81	21.00	5.37	27.00	7.00	34.00	43
ZR	262.40	253.00	80.03	360.00	96.00	456.00	43
TH	15.61	16.00	7.45	36.00	0.00	36.00	43
Y	50.65	52.00	14.25	75.00	20.00	95.00	43
LA	74.07	71.00	26.46	122.00	12.00	134.00	43
CE	148.19	145.00	50.83	256.00	24.00	280.00	43
U	4.94	4.70	2.20	12.20	1.50	13.70	43
F	644.16	683.00	385.72	1819.00	33.00	1852.00	43
SN	2.46	1.00	2.51	8.00	1.00	9.00	11
SC	2.32	2.30	0.97	2.80	1.00	3.80	11
AS	0.73	0.50	0.75	2.50	1.00	3.00	11
SB	0.13	0.10	0.09	0.30	0.10	0.40	11
CS	0.77	0.50	0.61	1.50	1.00	2.00	11
SM	10.07	10.00	4.10	13.80	4.20	18.00	11
TB	1.41	2.00	0.92	2.50	1.00	3.00	11
YB	4.05	2.50	2.16	4.50	3.00	7.00	11
LU	0.62	0.50	0.26	0.70	0.50	1.20	11
HF	10.00	10.00	3.29	9.00	6.00	15.00	11
TA	1.27	0.50	0.93	2.50	1.00	3.00	11
W	1.00	1.00	0.00	0.00	1.00	1.00	11

UNIVARIATE STATISTICS FOR UNIT 31.2 (BIG RIVER GRANITE - MARGINAL PHASE

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	74.81	75.30	1.47	4.70	71.15	75.85	15
TIO2	0.16	0.14	0.08	0.31	0.08	0.39	15
AL2O3	13.09	12.90	0.65	2.41	12.48	14.89	15
FE2O3	0.78	0.75	0.18	0.61	0.55	1.16	15
FEO	0.49	0.41	0.26	1.03	0.20	1.23	15
MNO	0.04	0.04	0.02	0.06	0.01	0.07	15
MGO	0.13	0.08	0.11	0.37	0.06	0.43	15
CAO	0.53	0.42	0.30	1.09	0.30	1.39	15
NA2O	4.59	4.34	0.85	3.95	3.46	7.41	15
K2O	4.47	4.76	1.18	5.08	0.40	5.48	15
P2O5	0.03	0.01	0.03	0.09	0.01	0.10	15
LOI	0.49	0.46	0.12	0.45	0.32	0.77	15
BA	227.67	118.00	272.26	938.00	72.00	1010.00	15
CU	3.07	3.00	1.62	6.00	2.00	8.00	15
ZN	17.27	13.00	14.83	57.00	1.00	58.00	15
PB	10.07	11.00	4.62	17.00	3.00	20.00	15
SR	81.27	37.00	109.97	423.00	24.00	447.00	15
NI	4.07	1.00	7.51	22.00	1.00	23.00	15
LI	12.13	12.00	5.95	25.00	4.00	29.00	15
RB	144.60	158.00	42.53	166.00	12.00	178.00	15
CR	4.73	2.00	6.96	25.00	1.00	26.00	15
V	10.56	9.00	8.22	22.00	1.00	23.00	9
MO	3.40	3.00	1.45	5.00	2.00	7.00	15
CO	1.00	1.00	0.00	0.00	1.00	1.00	8
AG	0.10	0.10	0.00	0.00	0.10	0.10	7
BE	5.14	4.60	1.56	3.80	3.50	7.30	8
GA	11.07	9.00	4.50	12.00	6.00	18.00	15
NB	22.27	22.00	6.16	28.00	5.00	33.00	15
ZR	201.13	198.00	39.87	165.00	122.00	287.00	15
TH	13.07	11.00	6.46	20.00	6.00	26.00	15
Y	32.40	35.00	10.32	38.00	9.00	47.00	15
LA	45.87	38.00	26.06	92.00	14.00	106.00	15
CE	93.60	81.00	47.70	180.00	27.00	207.00	15
U	5.85	6.00	2.01	6.70	3.00	9.70	15
F	1105.40	1085.00	533.51	2310.00	194.00	2504.00	15

UNIVARIATE STATISTICS FOR UNIT 32 (OTTER LAKE - WALKER LAKE GRANITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	67.57	67.50	3.80	14.40	59.85	74.25	28
TIO2	0.49	0.50	0.17	0.76	0.16	0.92	28
AL2O3	15.31	15.20	1.29	4.70	13.01	17.71	28
FE2O3	1.33	1.47	0.63	2.00	0.27	2.27	28
FEO	2.04	1.80	1.07	4.32	0.43	4.75	28
MNO	0.07	0.07	0.03	0.10	0.02	0.12	28
MGO	0.95	0.97	0.49	1.83	0.19	2.02	28
CAO	2.29	2.36	0.92	3.58	0.67	4.25	28
NA2O	3.98	4.09	0.52	1.96	3.00	4.96	28
K2O	4.68	4.49	0.72	2.44	3.79	6.23	28
P2O5	0.18	0.18	0.08	0.32	0.03	0.35	28
LOI	0.70	0.63	0.21	0.86	0.40	1.26	28
BA	994.46	888.50	437.91	1947.00	453.00	2400.00	28
CU	7.29	6.50	4.22	16.00	2.00	18.00	28
ZN	53.89	52.50	18.11	72.00	24.00	96.00	28
PB	17.39	14.50	8.23	34.00	8.00	42.00	28
SR	315.68	332.00	149.26	503.00	99.00	602.00	28
NI	1.64	1.00	0.95	3.00	1.00	4.00	28
LI	28.04	25.50	13.85	70.00	7.00	77.00	28
RB	133.75	127.00	49.97	220.00	74.00	294.00	28
CR	4.25	3.50	2.84	11.00	1.00	12.00	28
V	48.50	41.50	24.77	93.00	12.00	105.00	28
MO	2.79	3.00	0.83	3.00	1.00	4.00	28
GA	15.29	15.50	2.12	8.00	11.00	19.00	28
NB	14.07	14.50	4.88	20.00	4.00	24.00	28
ZR	143.82	131.50	49.82	238.00	82.00	320.00	28
TH	16.54	13.00	10.76	50.00	2.00	52.00	28
Y	31.25	29.50	9.12	42.00	8.00	50.00	28
LA	53.75	50.00	13.65	56.00	30.00	86.00	28
CE	106.18	96.50	25.21	89.00	60.00	149.00	28
U	3.74	3.35	2.09	11.20	1.70	12.90	28
F	717.29	727.50	221.50	1104.00	123.00	1227.00	28
SN	3.67	2.50	3.28	10.00	1.00	11.00	12
SC	5.87	6.00	2.18	6.80	3.20	10.00	12
AS	0.75	0.50	0.58	1.50	1.00	2.00	12
SB	0.18	0.10	0.15	0.50	0.10	0.60	12
CS	5.00	5.00	2.52	9.00	2.00	11.00	12
SM	9.52	8.50	2.66	10.00	7.00	17.00	12
TB	0.88	0.50	0.68	1.50	1.00	2.00	12
YB	2.50	2.50	0.00	0.00	3.00	3.00	12
LU	0.55	0.50	0.17	0.60	0.50	1.10	12
HF	12.67	7.50	20.03	71.00	5.00	76.00	12
TA	1.42	1.25	1.02	2.50	1.00	3.00	12
W	1.17	1.00	0.58	2.00	1.00	3.00	12

UNIVARIATE STATISTICS FOR UNIT 33 (BAYHEAD GRANITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	69.90	71.40	5.42	19.50	58.30	77.80	47
TIO2	0.43	0.30	0.34	1.13	0.07	1.20	47
AL2O3	13.87	13.69	1.34	5.48	11.42	16.90	47
FE2O3	1.05	0.79	0.73	3.31	0.10	3.41	47
FEO	2.37	2.03	1.44	5.88	0.30	6.18	47
MNO	0.07	0.05	0.05	0.25	0.01	0.26	47
MGO	0.52	0.22	0.65	2.22	0.01	2.23	47
CAO	1.52	1.08	1.16	3.93	0.47	4.40	47
NA2O	3.87	3.78	0.60	3.08	2.33	5.41	47
K2O	5.12	5.23	0.92	5.72	1.69	7.41	47
P2O5	0.10	0.04	0.11	0.40	0.01	0.41	47
LOI	0.57	0.57	0.18	0.77	0.23	1.00	46
BA	673.72	661.00	436.06	1447.00	13.00	1460.00	47
CU	4.62	3.00	4.36	21.00	1.00	22.00	47
ZN	73.64	73.00	31.87	164.00	20.00	184.00	47
PB	24.83	24.00	7.31	34.00	11.00	45.00	47
SR	119.34	76.00	114.72	392.00	2.00	394.00	47
NI	2.30	1.00	3.84	23.00	1.00	24.00	47
LI	23.23	16.00	19.38	76.00	1.00	77.00	47
RB	156.75	143.00	61.77	241.00	70.00	311.00	47
CR	4.79	3.00	4.96	25.00	1.00	26.00	47
V	15.85	10.00	21.75	127.00	1.00	128.00	40
MO	4.40	4.00	1.84	7.00	2.00	9.00	47
CO	3.75	1.00	4.74	13.00	1.00	14.00	24
AG	0.12	0.10	0.05	0.20	0.10	0.30	23
BE	3.73	3.00	1.66	5.60	1.80	7.40	24
GA	17.60	20.00	6.30	25.00	5.00	30.00	47
NB	25.15	25.00	9.88	40.00	5.00	45.00	47
ZR	246.15	240.00	96.96	385.00	50.00	435.00	47
TH	17.43	14.00	16.89	78.00	0.00	78.00	47
Y	55.02	54.00	21.60	87.00	11.00	98.00	47
LA	91.36	76.00	56.30	241.00	1.00	242.00	47
CE	180.51	143.00	102.80	449.00	5.00	454.00	47
U	4.68	3.50	4.12	26.50	1.80	28.30	47
F	970.04	737.00	761.52	3112.00	59.00	3171.00	47
SN	4.00	3.50	2.89	12.00	1.00	13.00	34
SC	4.56	3.00	4.27	13.25	0.50	13.70	35
AS	1.66	0.82	1.85	7.91	0.00	8.00	35
SB	0.26	0.12	0.31	1.52	0.10	1.60	35
CS	1.23	0.66	1.06	4.64	0.00	5.00	35
SM	13.08	11.00	7.32	31.67	0.30	32.00	35
TB	2.03	2.00	1.02	4.50	1.00	5.00	35
YB	5.26	4.90	2.24	7.50	3.00	10.00	35
LU	0.79	0.68	0.33	1.24	0.30	1.50	35
HF	10.95	10.00	6.52	39.20	1.00	40.00	35
TA	1.47	1.20	1.00	3.50	1.00	4.00	35
W	1.09	1.00	0.69	3.47	1.00	4.00	35

UNIVARIATE STATISTICS FOR UNIT 34 (STAG BAY GRANITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	68.86	69.62	4.05	20.50	54.65	75.15	20
TIO2	0.34	0.32	0.11	0.47	0.19	0.66	20
AL2O3	15.45	15.70	1.47	6.25	13.28	19.53	20
FE2O3	1.04	0.95	0.40	1.99	0.33	2.32	20
FEO	1.47	1.29	0.68	2.88	0.66	3.54	20
MNO	0.06	0.05	0.02	0.08	0.04	0.12	20
MGO	0.70	0.71	0.42	1.88	0.17	2.05	20
CAO	2.00	1.95	1.09	4.86	0.88	5.74	20
NA2O	4.49	4.56	0.43	1.97	3.17	5.14	20
K2O	4.26	3.88	0.86	3.08	3.32	6.40	20
P2O5	0.11	0.10	0.07	0.33	0.03	0.36	20
LOI	0.77	0.72	0.28	1.03	0.26	1.29	20
BA	998.55	1110.00	413.90	1423.00	287.00	1710.00	20
CU	47.95	5.50	179.28	807.00	2.00	809.00	20
ZN	49.35	44.50	17.60	61.00	27.00	88.00	20
PB	18.00	11.00	20.08	93.00	5.00	98.00	20
SR	461.50	579.00	267.32	877.00	110.00	987.00	20
NI	2.40	1.00	1.76	5.00	1.00	6.00	20
LI	17.85	17.50	4.15	16.00	9.00	25.00	20
RB	107.05	91.00	44.52	140.00	56.00	196.00	20
CR	3.85	3.50	2.08	7.00	1.00	8.00	20
V	12.26	9.00	10.32	31.00	1.00	32.00	19
MO	2.85	2.00	1.87	8.00	2.00	10.00	20
CO	3.89	3.00	3.92	11.00	1.00	12.00	9
AG	0.13	0.10	0.05	0.10	0.10	0.20	11
BE	2.94	2.60	1.04	3.10	1.70	4.80	9
GA	13.85	15.00	5.67	16.00	6.00	22.00	20
NB	13.25	7.00	9.77	28.00	3.00	31.00	20
ZR	219.65	140.00	136.93	502.00	91.00	593.00	20
TH	10.90	5.00	17.41	78.00	1.00	79.00	20
Y	24.90	13.00	19.98	65.00	8.00	73.00	20
LA	45.30	27.00	36.71	147.00	9.00	156.00	20
CE	90.55	53.50	76.72	295.00	21.00	316.00	20
U	4.41	3.70	3.42	11.90	0.50	12.40	20
F	742.20	441.50	628.11	2189.00	204.00	2393.00	20

UNIVARIATE STATISTICS FOR UNIT 40 (WITCHDOCTOR GRANITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	73.78	74.90	3.33	12.10	64.60	76.70	17
TIO2	0.15	0.10	0.15	0.53	0.03	0.56	17
AL2O3	13.77	13.32	1.22	4.54	12.67	17.21	17
FE2O3	0.65	0.48	0.59	2.54	0.21	2.75	17
FEO	0.63	0.56	0.26	0.96	0.23	1.19	17
MNO	0.04	0.04	0.01	0.05	0.02	0.07	17
MGO	0.15	0.12	0.12	0.46	0.04	0.50	17
CAO	0.75	0.61	0.41	1.63	0.38	2.01	17
NA2O	4.13	4.08	0.40	1.68	3.59	5.27	17
K2O	5.04	4.93	0.64	2.23	3.94	6.17	17
P2O5	0.02	0.01	0.03	0.11	0.01	0.12	17
LOI	0.45	0.37	0.14	0.47	0.28	0.75	17
BA	515.12	155.60	912.69	3847.00	23.00	3870.00	17
CU	3.35	2.00	2.57	7.00	1.00	8.00	17
ZN	25.06	22.00	8.20	25.00	16.00	41.00	17
PB	22.18	22.00	5.83	24.00	11.00	35.00	17
SR	75.35	54.00	83.49	355.00	6.00	361.00	17
NI	1.82	1.00	2.33	7.00	1.00	8.00	17
LI	14.29	9.00	13.62	44.00	1.00	45.00	17
RB	169.53	152.00	49.59	171.00	116.00	287.00	17
CR	3.77	1.00	4.88	15.00	1.00	16.00	17
V	10.13	11.00	7.54	27.00	1.00	28.00	16
MO	3.35	3.00	0.93	4.00	1.00	5.00	17
CO	1.00	1.00	0.00	0.00	1.00	1.00	5
AG	0.12	0.10	0.04	0.10	0.10	0.20	12
BE	4.88	4.30	1.03	2.50	4.00	6.50	5
GA	11.53	10.00	7.05	31.00	6.00	37.00	17
NB	16.88	14.00	16.41	71.00	2.00	73.00	17
ZR	136.06	123.00	44.76	192.00	78.00	270.00	17
TH	18.00	17.00	7.71	32.00	2.00	34.00	17
Y	23.71	19.00	27.46	123.00	3.00	126.00	17
LA	28.00	19.00	25.92	106.00	9.00	115.00	17
CE	60.88	46.00	55.43	232.00	29.00	261.00	17
U	5.55	4.20	4.02	16.50	1.00	17.50	17
F	137.88	89.00	97.67	313.00	20.00	333.00	17
SN	1.75	1.00	1.06	3.00	1.00	4.00	12
SC	2.33	1.95	1.42	5.20	1.10	6.30	12
AS	0.79	0.50	1.01	3.50	1.00	4.00	12
SB	0.10	0.10	0.00	0.00	0.10	0.10	12
CS	1.83	2.00	1.16	3.50	1.00	4.00	12
SM	3.86	3.75	1.37	3.90	2.10	6.00	12
TB	0.50	0.50	0.00	0.00	1.00	1.00	12
YB	2.50	2.50	0.00	0.00	3.00	3.00	12
LU	0.50	0.50	0.00	0.00	0.50	0.50	12
HF	5.00	5.00	1.04	4.00	3.00	7.00	12
TA	0.71	0.50	0.72	2.50	1.00	3.00	12
W	1.00	1.00	0.00	0.00	1.00	1.00	12

UNIVARIATE STATISTICS FOR UNIT 41 (BURNT LAKE GRANITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	72.71	73.55	3.11	11.85	65.50	77.35	17
TIO2	0.16	0.13	0.07	0.24	0.05	0.29	17
AL2O3	14.18	13.79	1.74	6.48	12.49	18.97	17
FE2O3	0.57	0.51	0.25	1.03	0.00	1.03	17
FEO	0.61	0.49	0.36	1.05	0.13	1.18	17
MNO	0.03	0.04	0.01	0.04	0.01	0.05	17
MGO	0.21	0.19	0.14	0.47	0.04	0.51	17
CAO	0.81	0.70	0.30	1.08	0.39	1.47	17
NA2O	4.40	3.94	1.53	5.90	3.70	9.60	17
K2O	4.93	5.02	1.07	5.60	1.27	6.87	17
P2O5	0.03	0.01	0.02	0.08	0.01	0.09	17
LOI	0.54	0.59	0.10	0.30	0.40	0.70	17
BA	522.94	419.00	328.66	1012.00	48.00	1060.00	17
CU	4.24	2.00	4.64	17.00	1.00	18.00	17
ZN	32.53	33.00	12.09	39.00	12.00	51.00	17
PB	31.41	33.00	13.99	54.00	4.00	58.00	17
SR	98.82	80.00	67.72	228.00	22.00	250.00	17
NI	1.53	1.00	1.94	8.00	1.00	9.00	17
LI	27.18	18.00	23.10	82.00	4.00	86.00	17
RB	212.77	234.00	78.36	335.00	32.00	367.00	17
CR	3.18	3.00	2.33	8.00	1.00	9.00	17
V	9.31	5.00	9.62	32.00	1.00	33.00	16
MO	52.82	4.00	202.09	836.00	1.00	837.00	17
CO	1.00	1.00	0.00	0.00	1.00	1.00	8
AG	0.11	0.10	0.03	0.10	0.10	0.20	9
BE	4.84	4.65	1.30	4.10	3.20	7.30	8
GA	11.87	11.00	4.07	11.00	7.00	18.00	15
NB	25.13	25.00	8.00	33.00	9.00	42.00	15
ZR	157.73	149.00	46.02	121.00	104.00	225.00	15
TH	20.27	21.00	10.77	43.00	1.00	44.00	15
Y	27.13	28.00	6.17	20.00	16.00	36.00	15
LA	34.27	30.00	17.56	60.00	13.00	73.00	15
CE	65.87	56.00	33.16	108.00	25.00	133.00	15
U	9.34	8.80	5.18	20.30	2.60	22.90	17
F	217.53	209.00	130.69	463.00	17.00	480.00	17
SN	2.82	2.00	2.48	9.00	1.00	10.00	17
SC	1.64	1.30	0.98	3.35	0.30	3.60	17
AS	0.87	0.50	0.64	1.86	0.00	2.00	17
SB	0.23	0.14	0.19	0.74	0.10	0.80	17
CS	1.97	2.00	1.42	4.90	1.00	5.00	17
SM	4.41	3.60	2.16	8.10	0.40	8.50	17
TB	0.55	0.50	0.19	0.80	1.00	1.00	17
YB	2.99	2.50	0.67	1.80	3.00	4.00	17
LU	0.55	0.50	0.11	0.46	0.40	0.90	17
HF	6.00	6.00	1.64	5.00	4.00	9.00	17
TA	2.35	2.30	1.13	4.00	1.00	5.00	17
W	0.91	1.00	0.17	0.47	1.00	1.00	17

UNIVARIATE STATISTICS FOR UNIT 42 (MONKEY HILL GRANITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	74.29	74.35	1.73	7.75	69.50	77.25	51
TIO2	0.12	0.11	0.08	0.41	0.01	0.42	51
AL2O3	13.44	13.52	0.80	4.55	10.79	15.34	51
FE2O3	0.70	0.54	0.53	2.47	0.10	2.57	51
FEO	0.45	0.39	0.33	1.27	0.04	1.31	49
MNO	0.05	0.04	0.04	0.21	0.01	0.22	51
MGO	0.16	0.14	0.11	0.43	0.02	0.45	51
CAO	0.71	0.63	0.35	2.03	0.07	2.10	51
NA2O	4.10	4.30	0.67	4.50	0.84	5.34	51
K2O	4.94	4.83	0.81	5.02	3.69	8.71	51
P2O5	0.03	0.02	0.02	0.09	0.01	0.10	51
LOI	0.57	0.54	0.24	1.55	0.20	1.75	51
BA	395.04	362.00	342.76	1634.00	6.00	1640.00	51
CU	8.88	2.00	20.38	114.00	1.00	115.00	51
ZN	32.29	32.00	17.17	84.00	6.00	90.00	51
PB	22.51	24.00	7.93	41.00	5.00	46.00	51
SR	140.39	105.00	237.75	1731.00	9.00	1740.00	51
NI	1.06	1.00	0.24	1.00	1.00	2.00	51
LI	20.57	17.00	12.92	57.00	3.00	60.00	51
RB	189.04	188.00	65.18	378.00	71.00	449.00	51
CR	2.63	2.00	1.78	6.00	1.00	7.00	51
V	12.54	13.00	10.51	31.00	1.00	32.00	41
MO	115.04	2.00	677.21	4751.00	1.00	4752.00	51
CO	1.19	1.00	0.40	1.00	1.00	2.00	21
AG	0.11	0.10	0.03	0.10	0.10	0.20	30
BE	4.78	4.70	1.50	6.70	1.20	7.90	21
GA	11.90	13.00	5.31	34.00	0.00	34.00	51
NB	17.35	16.00	9.19	47.00	3.00	50.00	51
ZR	149.10	139.00	80.72	498.00	18.00	516.00	51
TH	13.02	10.00	8.61	34.00	0.00	34.00	51
Y	28.51	22.00	26.19	132.00	2.00	134.00	51
LA	21.47	19.00	22.24	99.00	0.00	99.00	51
CE	43.51	35.00	45.65	209.00	0.00	209.00	51
U	5.63	4.30	5.46	35.70	0.50	36.20	51
F	510.73	480.00	443.02	2201.00	26.00	2227.00	51
SN	2.65	2.00	2.12	7.00	1.00	8.00	51
SC	1.29	1.00	1.17	6.55	0.30	6.80	51
AS	1.15	0.50	1.42	6.65	0.00	7.00	51
SB	0.17	0.10	0.24	1.64	0.10	1.70	51
CS	2.16	2.00	2.16	12.50	1.00	13.00	51
SM	4.38	3.30	4.15	21.50	0.10	21.60	51
TB	0.86	0.50	1.03	4.50	1.00	5.00	51
YB	4.01	2.50	3.74	20.80	3.00	23.00	51
LU	0.73	0.50	0.68	4.38	0.20	4.60	51
HF	5.34	4.60	2.88	17.00	1.00	18.00	51
TA	1.39	1.10	1.45	8.80	1.00	9.00	51
W	1.03	1.00	0.21	1.74	1.00	2.00	51

UNIVARIATE STATISTICS FOR UNIT 43 (CAPE STRAWBERRY GRANITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	73.03	73.85	2.93	13.60	62.50	76.10	53
TIO2	0.21	0.21	0.11	0.50	0.01	0.51	53
AL2O3	13.28	13.40	1.50	7.31	10.81	18.12	53
FE2O3	1.09	0.82	0.76	3.38	0.30	3.68	53
FEO	1.16	1.05	0.69	2.67	0.01	2.68	53
MNO	0.05	0.05	0.03	0.19	0.01	0.20	53
MGO	0.23	0.17	0.30	1.82	0.01	1.83	53
CAO	0.80	0.74	0.50	3.37	0.03	3.40	53
NA2O	4.15	3.90	1.13	6.79	2.92	9.71	53
K2O	5.03	5.16	1.14	7.89	0.28	8.17	53
P2O5	0.04	0.03	0.03	0.15	0.01	0.16	53
LOI	0.59	0.55	0.32	1.82	0.28	2.10	53
BA	338.11	384.00	240.16	844.00	30.00	874.00	53
CU	11.59	4.00	45.63	333.00	1.00	334.00	53
ZN	79.60	62.00	75.28	446.00	7.00	453.00	53
PB	24.11	24.00	10.41	46.00	2.00	48.00	53
SR	77.36	69.00	70.57	365.00	10.00	375.00	53
NI	1.79	1.00	4.04	29.00	1.00	30.00	53
LI	27.45	20.00	24.09	110.00	3.00	113.00	53
RB	187.04	181.00	58.99	326.00	10.00	336.00	53
CR	5.66	3.00	7.16	35.00	1.00	36.00	53
V	7.59	1.50	9.54	32.00	1.00	33.00	44
MO	3.57	3.00	2.08	13.00	1.00	14.00	53
CO	1.77	1.00	1.86	10.00	1.00	11.00	31
AG	0.11	0.10	0.04	0.20	0.10	0.30	22
BE	4.96	5.10	1.13	5.30	2.00	7.30	31
GA	16.45	14.00	7.26	26.00	7.00	33.00	53
NB	29.09	22.00	32.33	239.00	10.00	249.00	53
ZR	338.45	248.00	253.60	1091.00	32.00	1123.00	53
TH	24.94	17.00	28.24	161.00	2.00	163.00	53
Y	59.40	45.00	44.75	229.00	14.00	243.00	53
LA	74.43	75.00	45.32	188.00	1.00	189.00	53
CE	154.06	167.00	83.83	355.00	1.00	356.00	52
U	7.71	5.30	10.19	72.60	2.10	74.70	53
F	1415.06	1341.00	984.33	3990.00	33.00	4023.00	53
SN	5.02	5.00	3.09	12.00	1.00	13.00	53
SC	1.94	1.50	1.63	6.35	0.30	6.60	53
AS	2.61	1.80	2.85	14.50	1.00	15.00	53
SB	0.37	0.15	0.37	1.35	0.10	1.40	53
CS	1.25	1.00	0.85	3.59	0.00	4.00	53
SM	12.02	11.70	6.47	28.98	0.50	29.50	53
TB	1.85	1.50	1.43	5.70	1.00	6.00	53
YB	7.06	6.00	5.03	24.80	3.00	27.00	53
LU	1.01	0.61	0.80	4.19	0.30	4.50	53
HF	12.77	11.00	7.30	30.20	2.00	32.00	53
TA	1.77	1.80	1.19	7.30	1.00	8.00	53
W	1.03	1.00	0.37	2.64	1.00	3.00	53

UNIVARIATE STATISTICS FOR UNIT 44 (DOG ISLANDS GRANITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	70.97	72.40	4.88	26.05	49.95	76.00	31
TIO2	0.32	0.24	0.37	2.15	0.05	2.20	31
AL2O3	13.85	13.64	1.37	7.77	11.17	18.94	31
FE2O3	0.87	0.68	0.77	4.16	0.17	4.33	31
FEO	1.90	1.39	2.44	13.52	0.52	14.04	30
MNO	0.06	0.04	0.08	0.44	0.01	0.45	31
MGO	0.26	0.19	0.37	2.13	0.01	2.14	31
CAO	1.04	0.85	0.81	4.63	0.30	4.93	31
NA2O	4.07	4.03	0.49	2.84	2.63	5.47	31
K2O	5.42	5.31	1.29	8.32	3.08	11.40	31
P2O5	0.07	0.05	0.11	0.63	0.01	0.64	31
LOI	0.63	0.60	0.18	0.79	0.21	1.00	31
BA	449.55	470.00	198.33	735.00	32.00	767.00	31
CU	16.87	3.00	75.23	421.00	1.00	422.00	31
ZN	82.13	50.00	110.43	481.00	4.00	485.00	31
PB	119.52	26.00	516.28	2897.00	3.00	2900.00	31
SR	92.36	83.00	64.92	390.00	8.00	398.00	31
NI	1.13	1.00	0.43	2.00	1.00	3.00	31
LI	32.55	25.00	30.74	140.00	7.00	147.00	31
RB	203.74	192.00	73.42	450.00	88.00	538.00	31
CR	1.81	2.00	1.17	5.00	1.00	6.00	31
V	18.52	17.00	11.95	68.00	1.00	69.00	31
MO	6.52	3.00	18.93	106.00	2.00	108.00	31
CO	1.00	1.00	0.00	0.00	1.00	1.00	2
AG	0.12	0.10	0.04	0.10	0.10	0.20	29
BE	8.05	8.05	5.16	7.30	4.40	11.70	2
GA	22.42	21.00	7.97	44.00	12.00	56.00	31
NB	27.10	22.00	18.84	103.00	8.00	111.00	31
ZR	339.36	264.00	396.39	2286.00	134.00	2420.00	31
TH	21.81	17.00	23.10	106.00	0.00	106.00	31
Y	61.87	46.00	67.05	364.00	17.00	381.00	31
LA	141.48	110.00	220.70	1292.00	20.00	1312.00	31
CE	255.00	196.00	379.12	2224.00	42.00	2266.00	31
U	5.60	4.70	3.27	15.40	1.90	17.30	31
F	1916.39	1738.00	1464.85	7155.00	267.00	7422.00	31
SN	10.00	7.00	20.35	115.00	1.00	116.00	30
SC	3.97	2.40	6.63	37.21	0.60	37.80	31
AS	0.79	0.50	0.82	3.50	1.00	4.00	31
SB	0.13	0.10	0.15	0.81	0.10	0.90	31
CS	0.72	0.50	0.53	1.72	0.00	2.00	31
SM	16.13	12.00	18.74	109.40	3.60	113.00	31
TB	2.07	2.00	2.86	15.50	1.00	16.00	31
YB	7.07	6.00	6.92	33.50	3.00	36.00	31
LU	1.08	0.50	1.11	5.50	0.50	6.00	31
HF	17.13	11.00	25.13	145.00	5.00	150.00	31
TA	1.66	2.00	1.24	4.50	1.00	5.00	31
W	1.23	1.00	1.26	7.00	1.00	8.00	31

UNIVARIATE STATISTICS FOR UNIT 45 (TUKIALIK GRANITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	72.70	73.30	3.03	13.35	63.95	77.30	37
TIO2	0.27	0.23	0.12	0.47	0.10	0.57	37
AL2O3	13.22	13.19	1.11	5.21	11.36	16.57	37
FE2O3	1.02	0.86	0.53	2.39	0.34	2.73	37
FEO	1.15	0.99	0.79	4.51	0.33	4.84	37
MNO	0.06	0.04	0.05	0.26	0.02	0.28	37
MGO	0.27	0.20	0.24	0.90	0.04	0.94	37
CAO	0.84	0.68	0.46	1.69	0.30	1.99	37
NA2O	3.98	3.93	0.34	1.42	3.40	4.82	37
K2O	5.19	5.11	0.46	1.76	4.44	6.20	37
P2O5	0.04	0.03	0.04	0.13	0.01	0.14	37
LOI	0.77	0.76	0.25	1.40	0.30	1.70	37
BA	407.95	431.00	293.48	1369.00	41.00	1410.00	37
CU	5.95	4.00	3.80	15.00	2.00	17.00	37
ZN	62.03	45.00	46.75	176.00	15.00	191.00	37
PB	17.41	16.00	9.78	54.00	5.00	59.00	37
SR	104.89	79.00	106.77	467.00	18.00	485.00	37
NI	1.81	1.00	1.76	10.00	1.00	11.00	37
LI	21.46	14.00	23.46	101.00	6.00	107.00	37
RB	192.57	188.00	49.40	230.00	92.00	322.00	37
CR	5.43	4.00	7.92	49.00	1.00	50.00	37
V	7.03	2.00	10.15	41.00	1.00	42.00	29
MO	3.46	3.00	2.17	13.00	1.00	14.00	37
CO	1.77	1.00	1.31	5.00	1.00	6.00	30
AG	0.10	0.10	0.00	0.00	0.10	0.10	7
BE	5.61	5.30	1.98	6.40	2.70	9.10	30
GA	12.11	10.00	7.05	26.00	5.00	31.00	37
NB	22.11	20.00	8.12	28.00	10.00	38.00	37
ZR	281.38	216.00	169.93	900.00	125.00	1025.00	37
TH	12.30	8.00	9.34	49.00	2.00	51.00	37
Y	43.73	39.00	23.97	95.00	16.00	111.00	37
LA	68.43	57.00	43.10	208.00	24.00	232.00	37
CE	140.78	120.00	84.85	390.00	47.00	437.00	37
U	5.63	5.10	2.98	17.50	2.00	19.50	37
F	1589.46	1284.00	1317.82	4687.00	65.00	4752.00	37
SN	5.07	5.00	2.68	10.00	1.00	11.00	28
SC	2.49	2.10	1.62	6.36	0.80	7.20	29
AS	0.88	0.50	0.78	3.86	0.00	4.00	29
SB	0.22	0.14	0.20	0.79	0.10	0.80	29
CS	1.69	1.50	1.53	8.62	0.00	9.00	29
SM	10.25	9.20	4.62	15.60	4.60	20.20	29
TB	1.38	1.40	0.82	2.70	1.00	3.00	29
YB	6.03	5.00	2.55	7.70	3.00	10.00	29
LU	1.03	1.00	0.41	2.13	0.40	2.50	29
HF	12.08	9.10	6.16	24.80	5.00	30.00	29
TA	1.64	1.50	0.71	3.60	1.00	4.00	29
W	1.21	1.00	0.64	2.86	1.00	3.00	29

UNIVARIATE STATISTICS FOR UNIT 46 (LANCEGROUND AND PISTOL LAKE GRANITES)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	71.54	71.55	2.89	13.90	63.45	77.35	33
TIO2	0.36	0.30	0.27	1.31	0.13	1.44	33
AL2O3	13.19	13.15	0.92	4.30	11.29	15.59	33
FE2O3	1.42	1.38	0.72	2.71	0.23	2.94	33
FEO	1.66	1.50	1.08	4.55	0.47	5.02	33
MNO	0.08	0.07	0.05	0.20	0.02	0.22	33
MGO	0.21	0.16	0.20	0.96	0.02	0.98	33
CAO	0.97	0.80	0.56	2.13	0.19	2.32	33
NA2O	3.99	4.13	0.55	2.65	2.06	4.71	33
K2O	5.51	5.45	0.53	3.21	4.54	7.75	33
P2O5	0.06	0.05	0.06	0.26	0.01	0.27	33
LOI	0.58	0.56	0.24	1.38	0.26	1.64	33
BA	340.73	270.00	276.40	1208.00	42.00	1250.00	33
CU	7.58	4.00	13.87	82.00	1.00	83.00	33
ZN	104.64	102.00	61.35	194.00	15.00	209.00	33
PB	25.09	24.00	16.09	93.00	2.00	95.00	33
SR	60.00	35.00	62.11	235.00	6.00	241.00	33
NI	1.24	1.00	0.79	4.00	1.00	5.00	33
LI	13.42	12.00	7.14	29.00	4.00	33.00	33
RB	178.30	175.00	32.15	136.00	111.00	247.00	33
CR	4.03	4.00	2.54	9.00	1.00	10.00	33
V	7.96	5.50	9.54	45.00	1.00	46.00	24
MO	4.79	5.00	2.72	11.00	2.00	13.00	33
CO	1.33	1.00	0.59	2.00	1.00	3.00	18
AG	0.10	0.10	0.00	0.00	0.10	0.10	15
BE	6.43	6.50	2.36	7.60	2.50	10.10	18
GA	27.91	32.00	8.89	30.00	10.00	40.00	33
NB	30.91	35.00	12.74	45.00	7.00	52.00	33
ZR	464.88	426.00	380.07	2275.00	131.00	2406.00	33
TH	15.70	17.00	7.48	34.00	0.00	34.00	33
Y	79.58	86.00	36.28	143.00	17.00	160.00	33
LA	146.55	151.00	74.67	237.00	19.00	256.00	33
CE	292.94	337.00	147.40	464.00	38.00	502.00	33
U	4.89	4.90	2.04	8.30	1.30	9.60	33
F	1457.79	1426.00	1052.42	4255.00	80.00	4335.00	33
SN	3.97	4.00	2.46	8.00	1.00	9.00	33
SC	4.66	2.90	7.20	38.15	0.30	38.40	33
AS	0.94	0.50	0.82	3.23	0.00	4.00	33
SB	0.19	0.10	0.20	0.84	0.10	0.90	33
CS	1.09	0.94	0.63	1.73	0.00	2.00	33
SM	22.92	26.40	11.70	46.00	3.90	49.90	33
TB	3.17	3.60	1.85	8.50	1.00	9.00	33
YB	8.96	10.00	5.39	22.50	3.00	25.00	33
LU	1.36	1.50	0.78	3.13	0.50	3.60	33
HF	21.27	22.00	12.69	63.00	5.00	68.00	33
TA	1.74	2.00	0.96	4.50	1.00	5.00	33
W	2.83	1.00	7.05	39.48	1.00	40.00	33

UNIVARIATE STATISTICS FOR UNIT 47 (TARUN GRANITE)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	72.66	73.15	2.93	13.35	63.40	76.75	33
TIO2	0.31	0.32	0.10	0.40	0.16	0.56	33
AL2O3	12.95	12.89	1.45	7.48	11.18	18.66	33
FE2O3	1.11	1.02	0.36	1.57	0.51	2.08	33
FEO	1.41	1.30	0.70	3.17	0.58	3.75	33
MNO	0.06	0.06	0.03	0.12	0.02	0.14	33
MGO	0.18	0.13	0.16	0.71	0.01	0.72	33
CAO	0.85	0.71	0.45	2.13	0.34	2.47	33
NA2O	3.88	3.80	0.53	3.03	2.40	5.43	33
K2O	5.46	5.38	0.64	2.95	4.11	7.06	33
P2O5	0.04	0.03	0.03	0.10	0.01	0.11	33
LOI	0.51	0.53	0.18	0.64	0.19	0.83	33
BA	327.88	206.00	261.21	1039.00	21.00	1060.00	33
CU	5.15	4.00	3.73	20.00	2.00	22.00	33
ZN	81.42	73.00	49.00	185.00	15.00	200.00	33
PB	24.70	22.00	12.66	68.00	11.00	79.00	33
SR	62.03	37.00	75.09	411.00	5.00	416.00	33
NI	1.64	1.00	1.82	9.00	1.00	10.00	33
LI	14.49	11.00	16.19	86.00	5.00	91.00	33
RB	165.39	154.00	45.98	199.00	116.00	315.00	33
CR	3.94	4.00	2.49	8.00	1.00	9.00	33
V	8.18	6.50	7.08	18.00	1.00	19.00	22
MO	3.67	3.00	1.61	8.00	2.00	10.00	33
CO	1.55	1.00	0.74	2.00	1.00	3.00	22
AG	0.10	0.10	0.00	0.00	0.10	0.10	11
BE	4.77	4.65	1.46	5.80	2.70	8.50	22
GA	15.42	12.00	7.16	20.00	8.00	28.00	33
NB	28.91	28.00	8.67	39.00	13.00	52.00	33
ZR	371.12	340.00	107.86	428.00	166.00	594.00	33
TH	21.94	20.00	5.65	22.00	11.00	33.00	33
Y	76.46	77.00	27.31	134.00	26.00	160.00	33
LA	108.18	99.00	32.84	151.00	53.00	204.00	33
CE	219.94	206.00	65.34	304.00	98.00	402.00	33
U	5.93	5.70	1.69	8.30	3.40	11.70	33
F	1153.70	1113.00	755.49	3375.00	18.00	3393.00	33
SN	4.23	4.00	2.75	11.00	1.00	12.00	30
SC	3.15	2.60	1.69	5.80	0.60	6.40	31
AS	1.19	0.64	1.12	4.21	0.00	5.00	31
SB	0.16	0.11	0.11	0.39	0.10	0.50	31
CS	1.06	0.87	0.67	2.85	0.00	3.00	31
SM	18.03	16.50	6.61	29.40	6.70	36.10	31
TB	2.86	2.90	1.20	5.50	1.00	6.00	31
YB	8.50	9.00	2.94	11.00	3.00	14.00	31
LU	1.28	1.30	0.39	1.40	0.50	1.90	31
HF	16.81	14.00	6.99	26.90	8.00	35.00	31
TA	1.76	1.80	0.74	2.80	1.00	3.00	31
W	0.96	1.00	0.13	0.67	1.00	1.00	31

UNIVARIATE STATISTICS FOR UNIT 48 (SOUTH OF STAG BAY)

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	64.67	67.37	7.97	27.40	46.65	74.05	10
TIO2	0.50	1.02	0.29	0.81	0.21	1.02	10
AL2O3	16.74	16.40	2.29	7.55	12.98	20.53	10
FE2O3	1.42	1.07	0.74	2.31	0.77	3.08	10
FEO	2.13	1.88	1.38	4.62	1.06	5.68	10
MNO	0.08	0.07	0.05	0.13	0.03	0.16	10
MGO	1.73	0.71	3.37	11.18	0.09	11.27	10
CAO	3.05	2.17	2.86	9.74	0.75	10.49	10
NA2O	4.51	4.51	1.09	3.79	2.01	5.80	10
K2O	4.22	4.43	1.78	6.85	0.35	7.20	10
P2O5	0.13	0.09	0.10	0.29	0.02	0.31	10
LOI	0.49	0.42	0.18	0.67	0.22	0.89	10
BA	1794.80	1077.00	1812.87	4939.00	201.00	5140.00	10
CU	7.30	4.50	6.58	22.00	3.00	25.00	10
ZN	60.80	55.50	19.93	56.00	37.00	93.00	10
PB	12.10	10.00	8.53	33.00	1.00	34.00	10
SR	538.30	637.50	337.42	924.00	29.00	953.00	10
NI	12.70	1.00	34.91	111.00	1.00	112.00	10
LI	14.10	14.50	4.51	14.00	7.00	21.00	10
RB	69.00	58.50	61.40	215.00	16.00	231.00	10
CR	30.10	3.50	83.28	266.00	1.00	267.00	10
V	4.20	3.00	3.88	12.00	1.00	13.00	10
MO	3.00	3.00	0.67	2.00	2.00	4.00	10
CO	7.22	3.00	13.48	42.00	1.00	43.00	9
BE	1.54	1.60	0.46	1.40	0.70	2.10	9
GA	12.50	9.50	7.07	21.00	6.00	27.00	10
NB	9.00	6.00	8.52	25.00	1.00	26.00	10
ZR	181.00	99.50	206.06	604.00	13.00	617.00	10
TH	4.30	1.00	9.39	30.00	1.00	31.00	10
Y	19.20	14.50	16.02	52.00	5.00	57.00	10
LA	33.80	24.00	32.10	110.00	5.00	115.00	10
CE	65.20	43.50	66.36	218.00	6.00	224.00	10
U	1.39	0.55	2.12	7.00	0.10	7.10	10
F	647.00	447.50	657.24	2328.00	65.00	2393.00	10

UNIVARIATE STATISTICS FOR UNIT 50 (GRANITOID GNEISSES OF GRENVILLE PROVI

VARIABLE	MEAN	MEDIAN	S.D.	RANGE	MIN	MAX	N
SIO2	68.22	69.10	5.49	26.45	56.10	82.55	128
TIO2	0.51	0.41	0.35	1.52	0.01	1.53	128
AL2O3	14.70	14.84	1.57	9.34	10.26	19.60	128
FE2O3	1.25	1.09	0.63	2.72	0.17	2.89	128
FEO	2.15	1.73	1.40	6.76	0.03	6.79	128
MNO	0.08	0.07	0.04	0.16	0.01	0.17	128
MGO	0.77	0.58	0.73	5.15	0.02	5.17	128
CAO	1.91	1.67	1.22	6.36	0.14	6.50	128
NA2O	4.18	4.17	0.47	3.24	2.92	6.16	128
K2O	4.85	4.96	0.98	7.88	0.88	8.76	128
P2O5	0.16	0.10	0.15	0.66	0.01	0.67	128
LOI	0.55	0.53	0.20	1.25	0.18	1.43	128
BA	955.23	921.00	647.26	4308.00	32.00	4340.00	129
CU	13.47	6.00	58.00	662.00	1.00	663.00	129
ZN	67.20	63.00	31.63	138.00	5.00	143.00	129
PB	15.07	15.00	4.88	37.00	3.00	40.00	129
SR	262.89	239.00	191.48	808.00	12.00	820.00	129
NI	2.45	1.00	5.79	54.00	1.00	55.00	129
LI	20.30	20.00	9.51	41.00	3.00	44.00	129
RB	111.71	104.00	45.04	418.00	25.00	443.00	129
CR	8.21	4.00	25.98	277.00	1.00	278.00	129
V	10.37	5.00	18.41	157.00	1.00	158.00	109
MO	3.87	4.00	2.10	20.00	2.00	22.00	129
CO	4.74	3.00	4.04	19.00	1.00	20.00	93
AG	0.11	0.10	0.03	0.20	0.10	0.30	36
BE	2.98	2.80	1.12	8.40	1.30	9.70	93
GA	12.93	10.00	5.79	18.00	6.00	24.00	130
NB	15.18	15.00	7.24	48.00	1.00	49.00	130
ZR	172.07	164.00	89.57	458.00	22.00	480.00	130
TH	7.51	5.00	6.91	39.00	1.00	40.00	130
Y	33.27	35.00	15.22	79.00	6.00	85.00	130
LA	45.72	42.00	28.15	234.00	0.00	234.00	130
CE	93.55	89.00	53.23	408.00	0.00	408.00	130
U	3.49	2.85	2.42	13.50	0.60	14.10	130
F	680.99	702.00	404.39	1978.00	26.00	2004.00	126

Table 1

Oxide Wt. %	REGIONAL UNITS (n=131 or n=32) MEAN	MEDIAN	S.D.	MONKEY HILL INTRUSIVE SUITE (n=85 or n=51) MEAN	MEDIAN	S.D.	STRAWBERRY INTRUSIVE SUITE (Excluding BAYHEAD Granite) (n=92 or n=50) MEAN		S.D.	STRAWBERRY INTRUSIVE SUITE (BAYHEAD Granite Only) (n=47 or n=11) MEAN	MEDIAN	S.D.	LANCEGROUND INTRUSIVE SUITE (n=64 or n=26) MEAN	MEDIAN	S.D.
SIO2	67.33	68.20	5.61	73.97	74.20	2.47	72.62	73.35	2.93	69.90	71.40	5.42	72.13	72.22	2.98
TIO2	0.53	0.47	0.30	0.13	0.12	0.10	0.23	0.22	0.11	0.43	0.30	0.34	0.34	0.30	0.20
AL203	15.15	15.12	1.65	13.65	13.50	1.15	13.47	13.50	1.40	13.67	13.69	1.34	13.06	12.90	1.23
FE203	1.43	1.31	0.81	0.66	0.50	0.50	0.97	0.72	0.68	1.05	0.79	0.73	1.26	1.25	0.58
FEO	2.11	1.68	1.38	0.52	0.47	0.33	1.38	1.14	0.76	2.37	2.03	1.44	1.54	1.36	0.92
MNO	0.07	0.07	0.03	0.05	0.04	0.03	0.05	0.04	0.03	0.07	0.05	0.05	0.07	0.06	0.04
MGO	0.91	0.70	0.99	0.17	0.14	0.12	0.22	0.18	0.25	0.52	0.22	0.65	0.20	0.15	0.18
CAO	2.24	1.82	1.85	0.74	0.64	0.35	0.84	0.79	0.46	1.52	1.08	1.16	0.92	0.75	0.51
NA2O	4.15	4.18	0.59	4.12	4.09	0.67	4.15	3.95	0.93	3.87	3.78	0.80	3.92	3.97	0.51
K2O	4.78	4.88	1.00	4.95	4.97	0.83	5.12	5.16	0.98	5.12	5.23	0.92	5.48	5.40	0.54
P2O5	0.16	0.13	0.11	0.03	0.02	0.02	0.04	0.04	0.03	0.10	0.04	0.11	0.05	0.04	0.05
LOI	0.70	0.67	0.33	0.54	0.53	0.21	0.80	0.57	0.27	0.57	0.57	0.18	0.55	0.55	0.21
Element (ppm)															
LI	21.1	19.0	12.0	20.6	16.0	15.9	28.2	20.5	23.5	23.2	16.0	19.4	14.0	11.0	12.6
RB	129.0	129.0	47.7	188.9	182.0	66.0	188.4	185.0	52.7	156.7	143.0	61.8	172.4	188.0	40.0
CS	2.9	2.0	2.4	2.0	2.0	1.3	1.3	1.0	0.5	1.7	2.0	0.9	1.3	1.0	0.5
BE	3.6	3.6	1.1	4.8	4.6	1.4	4.9	5.1	1.1	3.7	3.0	1.7	5.5	4.9	2.1
SR	265.6	218.0	208.2	119.1	85.0	101.3	83.7	77.5	68.1	119.3	76.0	114.7	61.2	35.5	68.3
BA	944.4	861.0	457.0	444.6	340.0	502.9	382.0	427.0	232.6	673.7	861.0	436.1	333.1	258.0	257.7
GA	16.4	17.0	5.1	11.8	11.0	5.5	18.3	19.0	6.9	17.6	20.0	6.3	21.8	22.5	10.2
SN	2.8	2.0	2.6	1.9	1.0	1.6	5.5	5.0	3.6	4.3	4.0	2.5	3.7	3.0	2.8
PB	18.7	18.0	12.1	24.2	24.0	9.7	25.2	24.5	12.7	24.8	24.0	7.3	24.9	23.0	14.6
AS	1.6	1.0	1.4	1.3	1.0	0.8	1.8	1.0	2.0	1.3	1.0	0.5	1.5	1.0	0.9
SB	0.3	0.2	0.2	0.2	0.2	0.1	0.3	0.2	0.2	0.3	0.2	0.1	0.3	0.2	0.1
F	805.4	696.0	377.6	377.5	225.0	385.6	1491.9	1412.0	985.6	970.0	797.0	761.5	1327.5	1213.0	921.8
SC	4.8	3.7	3.3	1.7	1.3	1.3	2.7	2.4	2.0	2.4	1.6	1.8	4.5	2.6	7.1
V	35.0	22.0	38.5	11.3	11.0	9.7	11.5	10.0	9.8	15.9	10.0	21.7	8.4	7.0	8.4
CR	6.3	3.0	13.8	3.0	2.0	2.8	4.2	2.0	6.1	4.8	3.0	5.0	4.0	4.0	2.5
CO	6.5	3.0	11.1	1.1	1.0	0.3	1.8	1.0	1.8	3.8	1.0	4.7	1.4	1.0	0.7
NI	2.5	1.0	4.3	1.3	1.0	1.4	1.5	1.0	3.3	2.3	1.0	3.8	1.5	1.0	1.4
CU	17.4	6.0	72.7	6.8	2.0	16.1	8.6	3.0	35.8	4.6	3.0	4.4	8.5	4.0	10.3
ZN	61.8	56.0	28.3	38.9	31.0	15.0	71.0	57.0	65.7	73.6	73.0	31.9	93.2	85.0	56.3
Y	38.2	37.0	17.3	27.3	22.0	24.0	55.5	44.5	40.0	55.0	54.0	21.6	78.1	80.5	32.3
ZR	280.1	188.0	182.8	148.0	138.0	68.1	314.0	255.0	213.0	248.1	240.0	97.0	416.9	377.5	284.4
NB	16.1	15.0	7.2	18.7	17.0	11.2	27.4	22.0	26.8	25.1	25.0	9.9	28.8	28.0	11.0
MO	3.6	3.0	2.1	88.3	2.0	591.8	3.3	3.0	1.8	4.4	4.0	1.8	4.3	4.0	2.3
LA	58.9	54.0	27.0	25.1	18.0	22.8	85.1	81.5	45.2	81.4	78.0	58.3	128.1	117.5	81.0
CE	115.8	109.0	53.8	51.1	38.8	46.4	167.1	179.0	78.9	180.5	143.0	102.8	257.8	248.5	120.1
SM	8.9	8.3	4.8	4.1	3.6	2.6	12.6	11.5	5.8	12.8	11.8	7.8	28.1	18.8	11.7
TB	1.5	1.8	0.7	1.2	1.8	0.6	1.8	1.5	1.1	2.3	2.8	1.1	3.1	3.0	1.9
YB	5.4	5.0	8.8	5.1	5.0	0.4	7.1	6.8	3.5	6.5	6.8	1.8	8.8	8.5	4.8
LU	1.8	1.8	.8	1.8	1.8	.8	1.2	1.8	0.4	1.1	1.1	0.2	1.4	1.3	0.6
HF	10.9	8.8	12.4	5.1	5.8	1.7	12.5	11.0	5.2	10.3	10.0	4.8	21.5	21.8	14.6
TA	1.5	1.8	0.7	1.5	1.8	0.8	1.7	1.5	0.9	2.8	2.8	1.1	1.8	2.8	0.8
W	2.8	2.8	0.2	2.8	2.8	0.8	2.8	2.8	0.8	2.2	2.8	0.8	4.2	2.8	7.7
TH	12.5	18.8	18.8	15.3	18.8	8.3	21.8	17.8	23.8	17.4	14.8	18.9	18.5	28.8	7.2
U	4.2	3.7	2.3	8.4	4.7	5.3	8.7	5.2	8.3	4.7	3.5	4.1	5.4	5.3	2.8
K/RB	338	338	85	241	221	88	248	235	87	304	288	188	275	284	88
RB/SR	1	0.5	1.8	3.8	2.2	4.8	4.8	2.5	5.2	5.3	2.2	18.5	7.3	4.5	8.4
RB/BA	8	7	7.1	3.2	1.7	5.3	2.8	2.2	4.4	5.4	3.58	4.8	2.1	1.5	1.8
RB/SR+BA	1.1	1.1	8.4	8.8	8.8	8.4	1.4	1.4	8.8	1.3	1.4	8.4	1.7	1.7	8.8